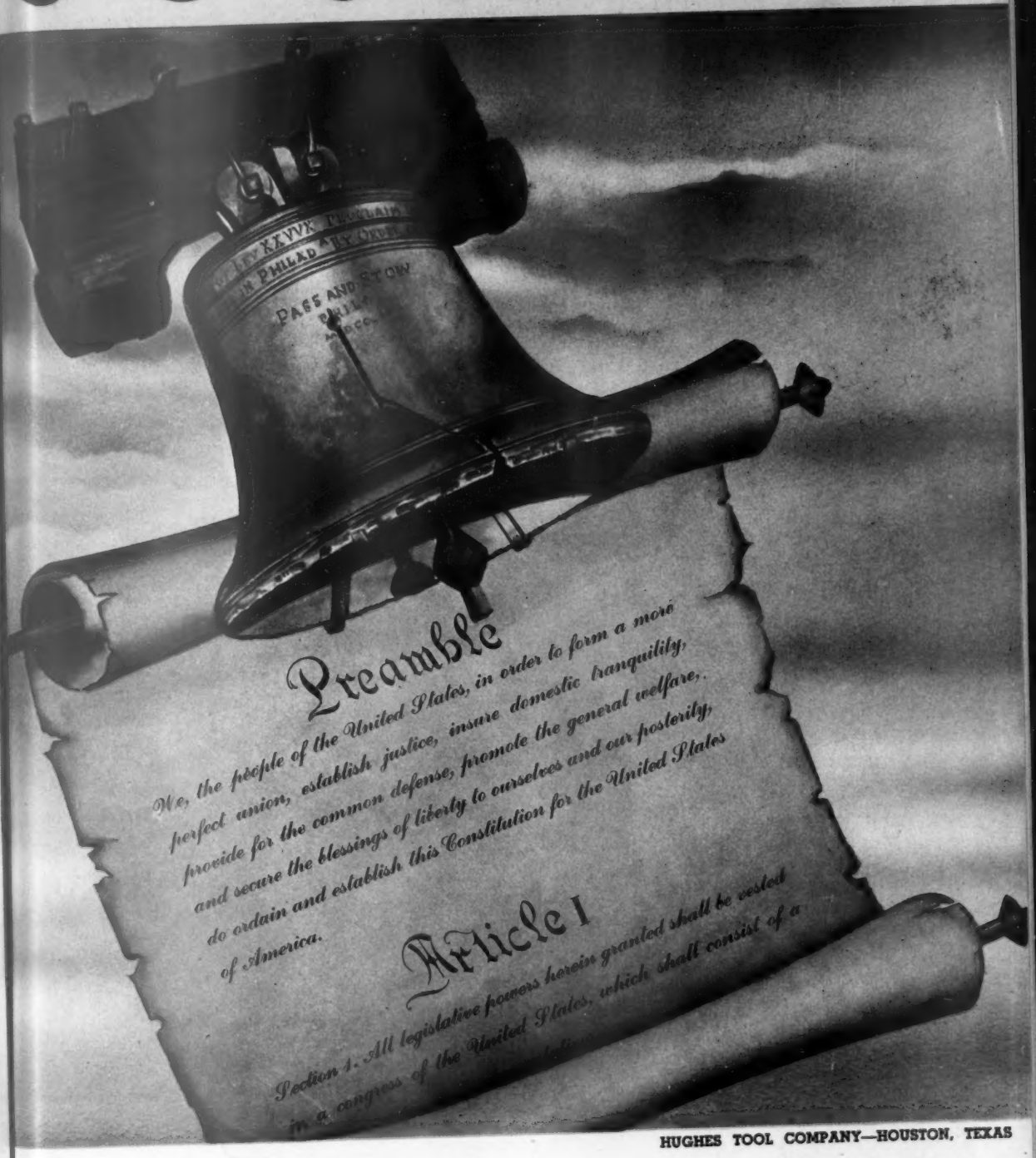
The OIL AND GAS JOURNAL


PASS AND STOW
Preamble
We, the people of the United States, in order to form a more perfect union, establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity, do ordain and establish this Constitution for the United States of America.
Article I
Section 1. All legislative powers herein granted shall be vested

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NOVEMBER 4, 1944

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the OIL AND GAS JOURNAL

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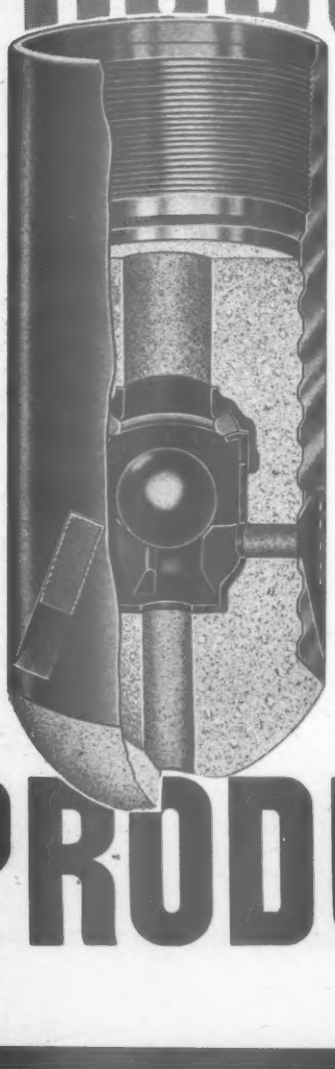

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Trends

Crude-Oil Production
By States—Page 134

CRUDE-OIL STOCKS 221,711,000 bbl. as of October 21—down 1,163,000 bbl. One year ago 235,998,000 bbl.

GASOLINE STOCKS 78,366,000 bbl. as of October 21—down 500,000 bbl.* One year ago 68,428,000 bbl.

RESIDUAL FUEL-OIL STOCKS 63,944,000 bbl. as of October 21—down 421,000 bbl. One year ago 64,816,000 bbl.

GAS OIL AND DISTILLATE STOCKS 48,360,000 bbl. as of October 21—up 1,025,000 bbl. One year ago 43,120,000 bbl.

CRUDE-OIL PRODUCTION 4,737,800 bbl. as of October 28—down 2,200 bbl. One year ago 4,396,300 bbl.

REFINERY RUNS 4,662,000 bbl. daily week ended October 21—up 73,000 bbl. Year ago 4,181,000 bbl.

*Figures for 10-14-44 revised.

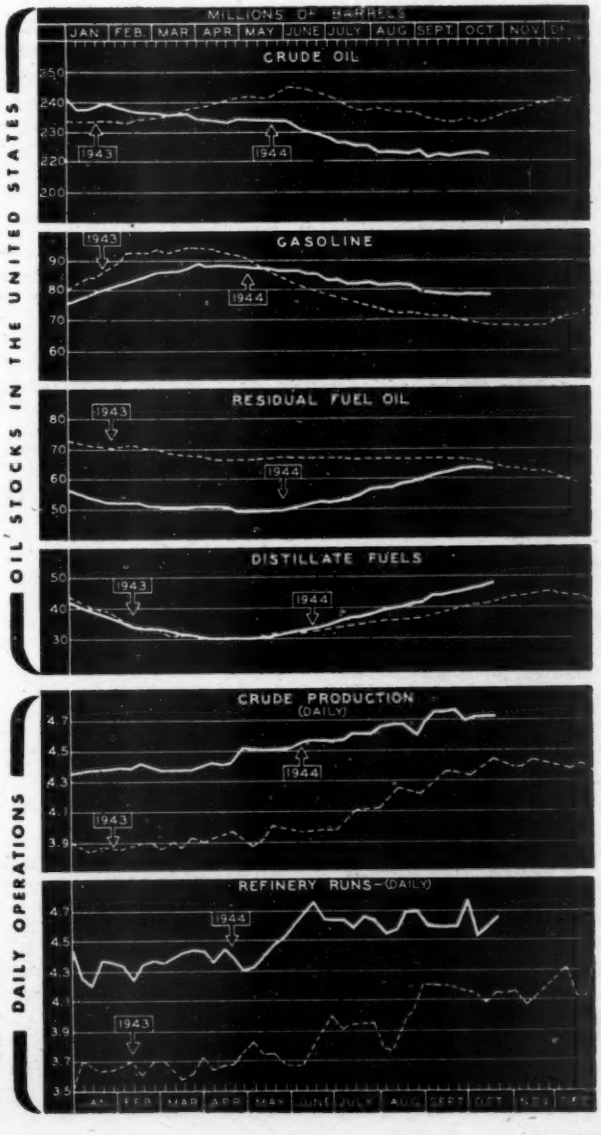
CONCERN is being expressed by some refining organizations as to whether outlets over the next few months will absorb the enlarged production and comparatively heavy stocks of residual fuel oils east of California. To a lesser extent the same question has been raised in local areas as to the disposal of products classified as gas oil and distillate. The following table summarizes the inventory and production data for residual fuel oils based on A.P.I. reports for comparable periods in October 1944 and 1943 (figures in thousands of barrels):

	Stocks		Production Week ending	
	Oct. 21, 1944	Oct. 23, 1943	Oct. 21, 1944	Oct. 23, 1943
Combined areas*	22,278	18,625	4,217	3,654
Appalachian	460	399	191	186
Ind., Ill., Ky.	4,033	3,223	1,119	1,003
Okla., Kans., Mo.	1,635	1,374	457	453
Rocky Mountains	610	694	194	202
California	34,928	40,399	2,711	2,151
Total	63,928	64,747	8,889	7,649

*East Coast, Texas, Louisiana, and Arkansas.

THIS report shows substantial percentage increases in residual fuel-oil stocks this year over a year ago with the exception of the Rocky Mountain states and California. A large part of the decrease in California took place in 1943 and since then operators have endeavored to maintain their stocks of the heavy oils through increased production and the importation of supplies from other parts of the United States and the Western Hemisphere. The situation in the combined areas has also been improved through the importation of low-gravity crude oils, principally from Venezuela, to the East Coast refineries.

ECONOMISTS from Petroleum Administration for War and from the industry have said that the domestic industry has nothing to fear from the enlarged stocks and production of fuel oils. It is pointed out that there has been little if any decrease in the domestic demands for the heavy fuels in this country and none is in prospect over the immediate future at least. Increases are developing in certain areas where users are being permitted to reconvert to oil from coal and other fuels. It has also been stated that should the production of fuel oils prove excessive within the next few weeks, adjustments can be made which will result in increased exports from this country.



PIWC Agrees to Further Study Of Anglo-American Oil Pact

by Henry D. Ralph

WASHINGTON.—The action of the Petroleum Industry War Council agreeing to further study of the pending Anglo-American oil pact means that the council may suggest modifications but cannot in the future oppose it outright, in the opinion of some of the council members who are most outspoken against the agreement.

After lengthy and heated debate at its October 25 meeting, PIWC voted down a resolution condemning the treaty and acceded to a request from the Petroleum Administrator for War, Harold L. Ickes, to make specific constructive suggestions for changes in its language.

This action was taken by a two-to-one vote in spite of the fact that no member of the council supported the agreement in its present form or even endorsed the idea that some type of international oil agreement is desirable. In fact, until Ickes made his request, it appeared that both the full council and its committee on national oil policy were prepared to go on record against the treaty by a virtually unanimous vote. Many of the members who voted for the prevailing motion explained that they did so only because they felt the administrator's request gave them no alternative and not because they approve of the treaty.

Council on the Spot

As a result, the council as such was virtually maneuvered into a position where it cannot oppose the treaty, and its future actions are limited to suggestions for specific changes in language. Such, at least, is the interpretation of several officials of the Petroleum Administration for War and of a good many members of the council. On the other hand, some council members took the view that the only question was whether the treaty would be condemned at this meeting or at the next, and that the intervention of the national election was a deciding factor because of a general desire not to make it appear that PIWC was getting into party politics by opposing an administration proposal.

Council's national oil-policy committee is now under instructions to hold another series of meetings and bring in a report to the next PIWC meeting, December 6, recommending changes in the language of the treaty designed to meet specific objections of the oil industry. There is no assurance that such suggestions will be adopted, but Ickes' request implies that they will be given consideration. The State Department is understood to be willing to withdraw the treaty from the Senate and ask the British for another conference to discuss changes provided the proposed changes are reasonable and there is assurance that they will be acceptable to the U. S. oil industry.

Ickes Argument Prevails

The national oil-policy committee was in almost constant session in Washington Sunday, Monday, and Tuesday preceding the PIWC meeting. At the outset there was virtually unanimous agreement on opposing the treaty and on the reasons to be stated in a resolution. A drafting subcommittee was appointed to word a report in the nature of a resolution to be presented to the full council. One member of the committee proposed an alternative resolution, carrying the same meaning but expressed in a shorter form.

While these two drafts were under discussion the committee was visited by the deputy petroleum administrator, Ralph K. Davies. Davies took vigorous exception to the proposed committee action, and argued his position at length. He was later joined in this by the State Department's petroleum advisor, Charles B. Rayner.

Still later the committee received a letter from Ickes, forwarded through William R. Boyd, Jr., chairman of PIWC, reading as follows:

"I understand that the Petroleum Industry War Council and certain of its committees desire to register objection to the recently negotiated Anglo-American oil agreement.

"If the council or any of its committees do so desire to record with me such views on the subject, I request that at the same time they make known their objections, they likewise make known in specific language exactly how, in their view, the existing document might be revised so as to remove the points of objection cited. This, in the interests of the creative and helpful approach, as opposed to a purely destructive one."

As a result, the committee recommended that Ickes' request be followed, and this was adopted by the council after long and heated discussion, during which Ickes appeared personally and made a brief explanation of his position.

Before the vote, however, a substitute resolution was proposed by George A. Hill, Jr., president of Houston Oil Co., and seconded by Ralph T. Zook, president of the Independent Petroleum Association of America. This was the text of the proposed report prepared by the drafting subcommittee, plus an additional paragraph offering the council's assistance in attempting to reach a new agreement with Great Britain. Several members spoke in support of this, but it was voted down. The text of the Hill-Zook resolution follows:

RESOLUTION

Whereas, the Petroleum Industry War Council heretofore has recommended certain basic principles in regard to a foreign oil policy for the United States as follows:

That the Government of the United States of America establish and maintain a consistent foreign oil policy

(a) by giving necessary and legitimate diplomatic support, under the principles of international law, to its nationals engaged in foreign oil operations;

(b) by fostering the private enterprise of its nationals in foreign exploration, production, transportation, refining and marketing of petroleum and its products;

(c) by the establishing as a cardinal principle in such foreign oil policy of the Government of the United States that the Government itself will not directly or indirectly engage in foreign oil ownership, exploration, development, or operation, either in its sovereign or proprietary capacity, or through the media of ownership in corporations or other agencies engaged in the petroleum industry;

(d) by creating an international instrument of consultation and collaboration, without power of enforcement and in which there is joint government-industry representation, as essential to further world oil developments on a basis of mutual respect; and

Whereas, on August 24, 1944, the president submitted to the Senate an Anglo-American oil agreement dated August 8, 1944, for advice and consent to ratification thereof; and

Whereas, the said agreement is in conflict with the principles above set forth;

Therefore be it resolved, that the Petroleum Industry War Council recommends that the Senate of the United States do not ratify the Anglo-American oil agreement submitted by the president for the reason that the said agreement clearly violates the foregoing principles and for the following additional reasons among others:

1. The purpose and scope of the agreement are obscure and ambiguous.

2. The scope of the activities of the International Petroleum Commission is not sufficiently limited.

3. No provision is made for the representation of the petroleum industry in the International Petroleum Commission.

4. The provisions of the agreement relating to recommendations by the commission do not make such recommendations solely advisory. So far as the governments are concerned, their approval of the recommendations is purely voluntary. As to operating companies, however, their compliance with the approved recommendations would be compulsory.

5. The agreement does not provide for the protection of the operating companies

in the action which they may take in compliance with approved recommendations of the commission.

6. Article 5 of the agreement is obscure as to the meaning of the term "country" and "territories" particularly in relation to Great Britain.

7. The ratification by the Senate of the Anglo-American oil agreement will vest in the Congress or the Executive Department of the United States Government or an International Oil Commission, powers in time of peace not now vested in the federal Government by the Constitution to:

(a) fix production quotas in oil-producing areas of the world, including the United States, and the several oil-producing states;

(b) make market allocations;

(c) fix prices of oil and its products, or price ceilings, or what may be deemed "fair prices";

(d) take jurisdiction over conservation regulations by making determinations of "sound engineering practices";

(e) regulate our domestic oil business in relation to the economic advancement of foreign oil consuming or foreign oil producing countries;

(f) surrender the control of import regulations and duties on foreign oil importations while the United Kingdom preserves "imperial preferences";

(g) regulate "the production, processing, transportation, and distribution of petroleum" in the United States; and

(h) legalize cartels.

8. If the agreement becomes a part of our national law, and is made to apply to the domestic petroleum resources, it would operate to take away from the sovereign states and divest them of their constitutional rights to regulate the production and conservation of petroleum and vest these powers in the Congress. Any executive or other agreement which would have the effect of vesting similar powers in the federal Government would be equally objectionable.

Be it further resolved, that it is recommended that no treaty be ratified or agreement be entered into which creates an International Commission having authority to perform any functions other than those of a purely consultative and advisory body, nor which would permit any recommendation for the enactment of legislation by the Congress of the United States.

Be it further resolved, the Petroleum Industry War Council reaffirms the principles outlined in the preamble hereof and in compliance with the request of the petroleum administrator for war, tenders its full cooperation in the complete exploration of all avenues which may lead to the development of an agreement with Great Britain that is in accord therewith.

No Threat Employed

Contrary to some published reports, neither Ickes nor Davies threatened to dissolve the council if it went on record against the treaty, neither did any members threaten to resign as a result of the action. Davies did express the view that the wartime industry-government team of PAW and PIWC could not function so smoothly in the future if the council should "slap the face" of the administration in this manner.

The arguments presented by Ickes and Davies were substantially these:

About a year ago the foreign operating committee of PAW offered an outline for a foreign oil policy and this outline was endorsed by PIWC except for the proposed mechanics of administration through an international compact commission, on which PIWC took no position. The pending Anglo-American oil agreement follows this outline 100 per cent, with the addition of an international commission to administer it. In drafting the language of the treaty every effort was made to use words which the negotiators thought made their meaning reasonably clear. Others in complete sincerity could interpret this language differently, but, having already endorsed the principles and policies attempted to be embodied in the treaty, these persons should make specific suggestions for language which will not be misinterpreted.

No effort has ever been made to stifle objections from the oil industry or elsewhere, and full discussion is welcomed. The agreement itself states that it is not to go into effect until both governments give notice, and this was done for the purpose of obtaining discussion and criticism. Senate leaders were told that full hearings were desired in order to obtain the oil industry's viewpoint before ratification. The door is not closed to modification of the treaty. The State Department is sympathetic to industry views and is ready to consider industry proposals; discussion would not have been invited if the administration had not been willing to consider changes.

But the British will not be asked to send another delegation to this country for further discussions unless there is some certainty as to what language will be accepted by the oil industry of this country. Those who negotiated and drafted the treaty thought they were doing a great job for the American oil industry, and that they were following the foreign oil policy recommended by the industry through FOC and PIWC. This administration is committed to the Anglo-American agreement and will not let it die, although if the administration does not push it the Senate probably would not take any action toward ratification.

The administration is absolutely convinced of the necessity for some form of collaboration between the United States and Great Britain on foreign oil policy, particularly because both nations have interests in the huge Middle East reserves which probably will dominate the world's petroleum economy after the war. Practically the entire oil industry shared this view "until one or two individuals started a wrecking job" by spreading the idea that there is no need for any sort of international collaboration in oil.

Since PIWC once went on record as favoring a policy which the Anglo-American treaty attempted to put into concrete form, the only decent thing for the council to do now is to specify wherein certain of its provisions fail of their objective. The practical approach to a practical situation is not to demand that the Government junk the treaty, but to come forward with constructive suggestions for improvement. Those who feel that the present language implies federal control of the domestic oil business should draft their own phraseology in a manner to rule out any misinterpretation.

In addition to these views, it is understood that Ickes raised the political aspect, deploring any partisanship on the eve of the election, and insisting that the council take no action at this time which might be interpreted as being a political move or as making political capital of an internal situation in the industry or in PIWC.

Pew Repeats Attack on Pact

WASHINGTON.—J. Howard Pew, president of Sun Oil Co., described the proposed Anglo-American oil treaty as a "deliberate attempt" to regiment the entire oil industry and warned a meeting here of the Petroleum Industry War Council that "the time to fight this menace to the American oil industry, its workers and the public, is today."

The proposed treaty, Pew said, "is a blank check which would give to the federal Government unlimited and unspecified powers of the greatest scope over every activity of our industry. The effectuation of its objectives can be achieved only through embroiling our domestic petroleum industry in a vicious cartel system"—a system detrimental to workers, to consumers, and to those with savings to invest.

Striking again at the ambiguous and vague language of the pact, the Sun Oil Co. president said the proposal is "just as innocuous or as vicious as its administrators desire to make it." He said he has no doubt, however, that if the proposed treaty is ratified, the executive department of the Government and in all probability the Supreme Court will construe its language as vesting in the chief executive such powers as will effectuate the policies set forth. These policies, he asserted, include price control and the allocation of production and marketing quotas.

"Such arrangements in international trade are exactly what we at

home call monopolistic practices or combinations in restraint of trade," Pew pointed out.

Brushing aside what he described as "efforts . . . made in some quarters to distinguish between so-called 'private cartels' and cartels under government control," Pew said the only difference is that cartels under the aegis of government "are far more reprehensible and detrimental to the public welfare than cartels entered into by individual companies."

Yet the oil cartel agreement, he said, is the first of a long series of similar cartels which the economic planners are preparing to ram down the throats of the American people.

"Because oil is the first of these agreements, and because we have had the opportunity of familiarizing ourselves with all of its implications, it becomes our solemn duty, as American citizens, to state our objections clearly and fully so that the Senate of the United States, as well as the American people, shall have a full understanding as to what is comprehended," Pew declared.

One of the most baffling aspects of the proposed treaty, he said, is its genesis.

"We have a right to know where this scheme originated and the purposes for which it was formulated," he said. "Likewise we have a right to know what relationship, if any, exists between the Anglo-American petroleum agreement and the Bretton Woods monetary agreement, the Dumbarton Oaks understanding and dozen and one other commodity agreements which are in the process of being negotiated on the pretext of promoting foreign trade in the postwar years."

Pew said he has no patience with arguments that other nations are so wedded to the cartel system that we must accept this method of doing business in the foreign field whether we like it or not.

"So great will be our economic strength after this war that the United States will not have to submit in foreign trade to the dictatorship of any nation," he declared. And if we accept the cartel system in foreign trade, he added, we cannot remain free in our domestic enterprise any more than a nation can survive "half free and half slave."

Council Opposes Further Economic Maladjustments

WASHINGTON. — Three resolutions opposing threatened spread of economic maladjustments in the industry and calling for relief from the current rigid restrictions on premium gasoline production for civilian distribution were adopted here last week by the Petroleum Industry War Council.

The council registered its opposition to a recommendation of the House select committee on small business for an increase in the price of crude oil unless such action is accompanied by compensatory upward adjustment in the price of refined products. PIWC reaffirmed its stand for higher crude prices but is opposed to lifting that end of the market unless refiners are permitted to pass on the higher costs to civilian consumers. PIWC resolved to strive for an adjustment of ceiling prices on petroleum to offset any increase in freight rates, a matter now pending before the Interstate Commerce Commission.

In another significant action, PAW was urged to increase the quantity of premium gasoline that may be manufactured from month to month as the supply of tetraethyl lead improves. Current regulations restrict premium gasoline production to about 25 per cent of the base volume.

Drilling-Material Manufacturing Rate Scheduled for Increase

WASHINGTON. — Plans for increasing the manufacture of rock bits and other critical items for drilling operations were disclosed here last week by Claude P. Parsons, director of materials, Petroleum Administration for War. He reported to the Petroleum Industry War Council that the number of active rotary rigs rose to the unprecedented peak of 1,806 at the end of October.

There has been an increase of 506 active rotary rigs since last January when 1,300 were active. This increase, Parsons reported, is one of the many important wartime achievements of the petroleum industry in meeting its responsibility of providing the required petroleum products. The difficulties of obtaining necessary materials will increase as the number of active drilling rigs continues to increase.

"In addition," Parsons pointed out, "practically all of the foreign petroleum drilling programs are expanding, and the rehabilitation of liberated oil fields will come into the picture. As the petroleum equipment manufacturers in the United States are the chief sources of supply for drilling operations all over the world, the combination of an unprecedented domestic drilling program and the increased foreign demand may further amplify the critical shortage of drilling equipment.

"Internal combustion engines, especially in the larger sizes, continue to be subject to more disturbing influences which affect deliveries than other critical items of equipment in the oil fields.

Deliveries of drilling engines, above 500 cu. in. displacement, are as follows: January 78, February 83, March 138, April 147, May 184, June 122, July 203, August 172, September 179; total, 1,306; average, 145.

"Deliveries of smaller engines for pumping purposes have improved considerably.

"Due to the extremely high number of rotary drilling rigs in operation and to the fact that the number is increasing, many difficulties may be expected during the fourth quarter because the production of drill pipe and tool joints cannot be increased proportionately.

DRILL PIPE PRODUCTION

(Feet, using 4½ in. 16.6 lb. as average)

1944:	
First quarter	2,120,000
Second quarter	2,324,831
Third quarter*	2,563,300
Fourth quarter*	2,743,613
Total	9,751,744

*Estimated.

1944:	Tool joint production (units)	Orders on hand (units)
April	25,107	244,718
May	27,411	260,055
June	27,388	280,077
July	28,701	332,498
August	29,675	349,000
September	32,652	354,961
October*	33,500	.....

*Estimated.

"We believe that drill pipe is being manufactured at a greater rate than it is being worn out, but the supply is not adequate at this time for both the replacements at old rigs and the initial needs at the greatly increased number of new rigs. Therefore, a flattening out of the rate of increase of drilling rigs, and a little time, should make the drill-pipe situation easier.

Several of the tool-joint manufacturers are expanding their facilities. This is difficult because the acquisition of new machines for the manufacture of tool joints runs into direct conflict with the Army because the same type of machines is in great demand by the Army for turning out artillery shells. We are as-

(Continued on page 50)

THIS WEEK

INTERNATIONAL—Petroleum Industry War Council agrees to continue study of Anglo-American oil agreement. . . . Outright condemnation rejected after personal appeals of Administrator Ickes and Deputy Davies. . . . Council action interpreted by some as tying its hands for subsequent denunciation. . . . Channels wide open, however, for suggesting changes in language objectionable to industry. . . . Before Ickes' personal plea, PIWC apparently unanimous in opposition. . . . ¶Laxity charged at council meeting in review of petroleum-equipment exports, both on lend-lease arrangement and at instigation of president's protocol committee. . . . WPB defends system of review, asserting recipient foreign countries must show necessity under fixed standards of war requirements. . . .

PRODUCTION—Estimated maximum efficient rate of production increased 85,000 bbl. per day, PAW reports. . . . New reserves at Elk Hills and West Edmond are chiefly responsible. . . . PIWC told, however, that current withdrawals must be sustained—regardless of when European war terminates—until Japan is defeated. . . . ¶Crude-oil production fairly static around 4,740,000 bbl. daily. . . . California output skids 9,000 bbl. daily. . . .

DRILLING—Rotary rigs actually drilling rise to unprecedented peak of 1,806. . . . Cable tool rigs actually drilling reported at 1,706. . . . Grand total of active drilling wells, 3,512, does not include authorized locations and shut-down operations. . . . ¶Arrangements made to increase production of tool joints and rock bits. . . . ¶Capacity for manufacturing drill pipe indicates the number of active rotaries will level off, perhaps at levels slightly above current curve. . . . ¶PAW reports scheduled completion of 27,000 wells next year is absolute minimum, more would be preferred, to sustain productive capacity. . . .

TRANSPORTATION—Percentage of gasoline moving north through WEP 20-in. product line increasing, permitting higher deliveries at Linden, N. J. . . . Natural gas started through Tennessee Gas & Transmission Co. 1,256-mile line from Texas to West Virginia. . . . Tank-car deliveries to District 1 barely more than 500,000 bbl. daily, about 50 per cent of the rail-traffic peak. . . .

SUPPLIES—Delay of consumers in ordering winter requirements of fuel oil backing up stocks at terminals. . . . ¶Certain refiners are cutting runs to avoid further accumulation of fuel oils, decline to transfer crude supplies to more fortunate plants. . . . Particularly mild fall cause of tardy attention to fuel tanks. . . .

PRICES—Regulations issued for qualifying high-cost fields for subsidy payments. . . . Arbitrary ceiling of 60 cents per barrel placed on allowable costs. . . . System will be administered through OPA with aid of district advisory committees. . . . Isolated high-cost operations are disqualified because determination of "hardship" must be on field-wide basis. . . . Maximum payment, regardless of cost representations, is fixed at 35 cents above previous ceilings. . . .

Postwar rehabilitation of the Manheim refinery, located between Cologne and Dusseldorf on the Rhine River in Germany, is strongly indicated by this picture made from one of the attacking planes as Liberators of the Eighth Air Force drove their bombs into the strategic target

(U.S. Army Air Forces Photo from International News Photos)

Atlantic Economist Declares Removal of Control Essential To Postwar Business Growth

COLUMBUS.—The removal of government control over American industry and the resumption of prewar freedom for business competition in the period following the war were strongly advocated here October 26 by John D. Gill, chief economist of Atlantic Refining Co., in an address before the Ohio Petroleum Marketers Association.

Gill criticized the Federal Power Commission's interpretation of a provision of the Natural Gas Act to justify the prevention of construction of interstate natural-gas pipe lines if the result of their use would affect adversely the interests of competing fuels, established transportation systems and related interests. He said in part:

"The Federal Power Commission may think it knows better than anyone else how to utilize the natural-gas resources. The chances are very great that it does not, that it cannot foresee the avails and costs of fuels of various sorts nor the needs for them down through the decades and generations still ahead.

"So far as we have knowledge, natural gas is essentially a fuel, to be burned to best advantage, whether in internal combustion engines or under boilers. Because of its very high methane content, most of our natural gas is chemically refractory. It may be many years before the petroleum industry will be able to utilize natural gas in a big way for the production of liquid combustion engine fuel. Moreover, the superabundant availability of natural gas as a chemical raw material enormously overshadows the market potentialities for chemical products that might be made from it.

"The known reserves of natural gas are enormous. Perhaps the commission overlooks this fact. Up to the recent past, the development of the natural gas industry has taken place along economic lines. Risk takers built gas pipe lines to markets when they thought they saw enough gas reserves to justify the necessarily large investment in the gathering and transportation system. When the reserves were deemed inadequate, or when they were unknown, there was no wasteful investment in transportation lines.

"If natural gas development is permitted to take place in a strictly economic way, that is according to competitive practice, the country may be interwoven with a useful system of gas pipe lines. Of course, owners of competing fuels and of the transportation systems carrying competing fuels may remonstrate. That is a situation that develops in all interindustry competition. Regardless, the general interest would be advanced by giving the gas industry its head.

"The competing natural resources —gas, petroleum and coal — should have the opportunity to spread their wings just as competing transportation media—tankers, railroads, trucks, buses, airplanes — should have. The widespread use of natural gas under boilers and otherwise is a labor-saving device which would advance our country industrially and raise our standard of living. The utilization of gas increases interindustry competition and reduces prices.

"I have so much more confidence in the economic sense of many independent competing business managements than I have in the judgments of any governmental agency that I am willing to believe that it might be better for the entire economy to have large quantities of natural gas burned under boilers in close proximity to the gas source, if the business managements so planned it and spent their capital funds for it, than it would be to withhold the gas from all use for an untold number of years, or to transport the gas, at considerable cost, to distant points for the purpose of using it in some commission-approved manner."

Gill traced the growth of the petroleum industry through a period of economic freedom to its present important place in the nation's business structure. He pointed out that the leading four producers controlled only 20.3 per cent of the crude-oil production; the leading four refiners controlled only 35.7 per cent of refinery operations, and the leading four marketers probably distributed not much over 25 per cent of the chief products up to the dealer level, and a much smaller percentage at the consumer level.

Speaking of postwar employment trends, Gill stated:

"More than half of our total labor force is now in the service industries, whereas 70 years ago only about one-fifth was in this category. There is every reason to expect this trend to continue, perhaps with increasing acceleration growing out of the greater manufacturing efficiency.

"It was the petroleum industry, through its extension of service, that did much to alleviate the unemployment of the early thirties. It may be our industry, by satisfying a growing demand for service and by the initiative of persons who wish to enter the business in self-employed capacities, that will do much to bridge the gap between the hectic wartime operation and the smooth peacetime operation of the economy."

Final Weld Made on Tennessee Line

The final weld on the Tennessee Gas & Transmission Co.'s system was made at 7 p.m., October 29 near the Buffalo River, Tennessee, thus completing the 1,265-mile line from Corpus Christi, Tex., to Cornwell station near Charleston, W. Va. Gas deliveries started at 1 p.m. October 31. The system has been designed to operate initially for delivering 207,000,000 cu. ft. daily to United Gas Fuel Co. in Kentucky and Hope Natural Gas Co. in West Virginia. Ultimately the number of stations will be increased, enabling the company to handle 262,000,000 cu. ft. of gas.

A special section starting on page 100 of this issue presents articles regarding the Tennessee staff, engineering features, compressor-station design and line construction.

1945 A.S.M.E. Conference To Be Held in Tulsa

A group conference of delegates from six local sections of the American Society of Mechanical Engineers in Texas, Louisiana, Oklahoma, Kansas, Colorado and Arkansas will meet in Tulsa in 1945, according to announcement by O. L. Lewis, Jones & Laughlin Supply Co., chairman of the conference.

The meeting this year in Dallas gave its attention mainly to working out a postwar employment program for engineers returning from military or special war services.

Park Jones' Series on Mechanics Of Production Starts This Issue

THE Oil and Gas Journal presents in this issue the first of a series of articles on the Mechanics of Producing Oil, Condensate, and Natural Gas. The series was prepared by Park J. Jones, widely known petroleum production engineer, whose practical experience in crude-oil and natural-gas operations has included work in many fields of several states. Jones recently resigned his connection with the Houston headquarters of The Texas Co. to engage in consulting work.

"I propose to make these articles as practical as possible" Jones explained in outlining the series to the Journal's editors, "hoping that they may become a standard reference on the mechanics of production for the field and operating personnel and a text for students of petroleum engineering."

The series will bring up to date the latest scientific findings and practices in the production of liquids and gas from wells with discussions based on the author's studies and findings over a period of 13 years. The articles will cover all the production operations.

As pointed out by Jones in his outline of the series, the principal characteristic of reservoirs is nonconformity. No two reservoirs are alike. The pay in one reservoir may be a well-sorted sandstone and in another a fractured limestone having pinpoint porosity. The oil found in reservoirs varies from 12° up to 55° gravity, A.P.I. The volume of gas dissolved in oil ranges from a few cubic feet up to as high as 2,000 cu. ft. per barrel. The interstitial water found in reservoirs ranges from about 5 per cent up to about 65 per cent. The gas found in reservoirs may be dry or it may contain up to 100 bbl. of condensate per million cubic feet of gas. The significance of these varying conditions in the Jones series will be translated into modern practices which have withstood economic and engineering tests.

The series has been prepared so that each article is a complete unit covering a particular subject. While the greatest value from the series will be secured by those who read each article from week to week where this is not possible other readers can secure practical benefits by taking advantage of those discussions which have a direct bearing on their own operations.

Subjects of Articles

Following are the subjects of the articles which appear in this and the next four issues:

1. Elements of Production Mechanics, starting on Page 53.
2. Porosity, Number of Voids, and Surface Area.
3. Properties of Water Found in Reservoirs.
4. Interstial Water, Gravity and Capillary Pressure.
5. Permeability, Type of Pay and Interstial Water.

The entire series will consist of 30 articles.

Mr. Jones received his bachelor of science degree in petroleum engineering and geology from the University of California in 1931. He also did graduate work in petroleum engineering and geology. With this academic background he started to work in the oil fields, his first job consisting in the removal of weeds by means of a hoe on town-lot leases in California. This was followed by work as a roustabout, roughneck, junior engineer and finally engineer. His work carried him to fields in California, New Mexico, Texas, Louisiana, Oklahoma, Illinois and Colorado. During the past few years he has devoted considerable time to cycling and the production of condensate in Texas and Louisiana. The value of his work has been widely recognized. By request he has conducted classes within and outside his company for those especially interested in production engineering practices.

Plans for the series on mechanics of production were made at this conference several weeks ago between members of the Journal staff and Park J. Jones. Counter clockwise around the table are Jones, C. O. Willson, Kenneth B. Barnes, H. Stanley Norman and P. C. Lauinger, president

High-Cost-Field Subsidy Rules Are Issued

WASHINGTON. — Procedure for granting price subsidies on crude from high-cost wells producing more than 9 bbl. per day and therefore not classified as stripper wells has been announced by the Office of Price Administration, and operators may submit applications to the petroleum-price branch in Washington at any time.

Applications will be sent by OPA to the regional stripper-well industry advisory committee which will ascertain the producers in each pool and supply operators with cost forms which will be ready for distribution within a few days. Committee members will assist producers in making out these forms if requested.

OPA has adopted an arbitrary figure of 60 cents per barrel as representing all overhead, capital, and other indirect costs, and from information on the cost forms it will compute the additional direct operating costs and determine whether this additional cost qualifies the pool for a premium price.

The amount of increase to be granted any pool will be the amount by which the sum of average direct operating costs of all producers in the same pool in the last quarter for which costs are submitted and 60 cents per barrel exceeds the existing maximum price of the pool. In no case will an adjustment be made unless direct operating costs are at least equal to one-third of the existing ceiling price before adjustment.

The maximum subsidy permissible is 35 cents per barrel, and the subsidy will be granted where the present ceiling price of a pool is below the average cost of production because of certain high-cost factors and where the cost of production is not out of proportion to the output obtainable. Pools already classified as strippers will not be eligible for further subsidies under the high-cost procedure.

What Others Say

Factual World Oil Study Proposed

Houston, Tex.

Dear Sirs:

Most of the published and spoken comments on the proposed Anglo-American oil compact which have come to my attention are confined to objections to it and urge the necessity of preventing its adoption. This is to the exclusion of any attention at this time to the reasons for having such an engagement between these two governments, and possibly others later, or to the outlook which suggested the advisability, perhaps necessity, of having such an engagement.

I am opposed to the proposed treaty as drafted but I feel that the current campaign to reject the entire document rather than to amend and alter it to retain desirable and unopposed features—is an improper approach. It might result in delaying, or even postponing indefinitely, some arrangement that may prove vital to the welfare of the oil industry of the United States, and particularly to the best interests of American independent oil operators who now are most vociferous in their disapproval.

It seems to me that the draft as presented combines three features: (1) A fact-finding body to make the best possible estimates of available supply and probable demand for petroleum and its products; (2) recommended allocation of quotas of supply and demand to the various geographical areas; (3) the adoption of an acceptable program by the several governments concerned, so that their nationals can proceed in a legal, orderly and efficient manner in the conduct of the world oil trade.

There is grave doubt that these three stages could be, or should be, combined into a single agreement and most of the difficulty seems to have arisen because that was attempted. Even if "men of good will" studied the question carefully, in all of its phases, and evolved this solution, the time is not ripe nor the means now at hand to devise such an arrangement.

If the three component stages are considered separately, there might be nearly or entirely unanimous agreement that at least we should get at the facts. Until all pertinent data are assembled and analyzed, how can any program be devised, much less adopted blindly in advance? We should first get the facts and then see what they suggest. An international oil compact commission should be established now and start assembling the facts. Such a joint advisory agency could do no harm and undoubtedly would be of great benefit in bringing about a widespread knowledge of the exact situation. It probably should be a continuing agency, constantly assembling, analyzing and revising the data and giving them the fullest publicity, not merely a committee to meet once and bring out a report on the then current situation. Surely nobody would object to a marshaling of the facts.

A simple statement of the statistics on supply and demand cannot of itself develop stability in the world's oil markets. Therefore, the second stage, a recommendation on the allocation of quotas, next follows. There is no reason why the personnel charged with the responsibility of gathering and studying the facts should not be in a good position to recommend quotas; in fact they should be the ones best fitted to do so. If the commission were properly staffed by experienced, capable, objective and realistic personnel, their recommendations should merit careful attention. The advantage of this second stake, recommending quotas, is parallel to the necessity for the second stage, gathering facts. The acceptability of their suggestions, however, would be tied up with the competence of the staff to be selected, and no information has been forthcoming on that as yet.

The third stage, adopting the quotas, is the one which has aroused all of the current controversy, and small wonder. With no foreknowledge of what the facts would disclose, and hence no idea of what recommendations would be formulated therefrom, how can we discuss or even conceive of the imposition upon the oil trade of two great nations of such unknown findings of a body not yet organized? It is specious to debate now questions of national sovereignty, questions of constitutionality, questions of government control, when few if any of us have the faintest idea of what might evolve from all this. But let us get the facts first.

Why start with the intangibles, the imponderables, the unknowns, and attempt to proceed toward a concrete system intended to accomplish any definite results? Why not start with the facts and then try to enunciate principles and to design methods to attain the desired goals? The principal error in the present document, it seems to me, lies in its effort to combine all three stages into one agreement worked out blindly in advance.

It may develop that no international agreement needs to be undertaken at this time, although the probabilities favor the assumption that we will find a need for a balanced program of supply and demand on a world-wide scale such as became so evident in the domestic oil industry 15 or 20 years ago. What we then learned here the hard way, with great cost and loss, perhaps can be applied elsewhere if adequate and acceptable machinery to provide it is set up. This is undoubtedly the best time to attempt a beginning. We should proceed cautiously but steadily, and then see just how far we can go, and need to go, along those lines. But let us get the facts first.

Sincerely yours,
J. ELMER THOMAS.

U.O.P. Reduces Royalty To 3 Cents a Barrel

CHICAGO. — Universal Oil Products Co. has announced, effective November 1, 1944, the third reduction of royalty rates in its history. The royalty rate for U.O.P. thermal cracking will be 3 cents instead of the previous 5 cents per barrel.

In 1922, when the first U.O.P. cracking unit was installed the royalty rate was fixed at 15 cents per barrel throughput and a yield of 21 per cent of gasoline was guaranteed.

By 1934, despite the enormous increases in yield and quality of products the royalty was lowered one-third or to 10 cents per barrel. Again in 1938—just 4 years later—the process was still further improved and again the royalty was cut; this time in half, or to 5 cents per barrel.

From 1922 to 1944 the yield of gasoline has been increased from 21 per cent to over 60 per cent on a comparable charging stock, services to licensees have expanded, while the royalty rate has been reduced from 15 cents to 3 cents a barrel—an 80 per cent reduction.

This represents three times the original yield of gasoline, while the reduction in royalty has been to one-fifth of its initial rate.

Universal will give more service and will continue to give broad patent protection.

Controllers to Hear Burk Discuss Job Evaluation

DALLAS. — "Purposes and Needs of Job Evaluation Within Industry," is the subject of an address to be given here November 16 by Samuel L. H. Burk, chief job analyst for The Atlantic Refining Co., Philadelphia, at a meeting of the Dallas control of Controllers Institute of America, in the roof garden of Adolphus Hotel. Invitations to attend the meeting have been extended to various organizations in the Southwest.

Burk, a leader in development of job-evaluation programs, has contributed substantially to plans for expanding the scope of job analysis and for meeting salary problems which have arisen as a result of the war emergency. Before joining Atlantic Refining he was connected with a management concern in New York engaged in the installation of job-evaluation programs and general studies of office and plant methods. He has expanded the job-analysis program to include essentially all types of technical and operating positions within his company. He was on leave during part of 1943 and 1944 to the Navy Department as manager of industrial relations for one of its plants in the East.

S.A.E. Meeting in Tulsa

All-important problems of fueling and lubricating automotive land, sea and air equipment will be discussed in terms of present and postwar requirements at the S.A.E. National Fuels and Lubricants meeting in the Mayo Hotel, Tulsa, November 9 and 10, John A. C. Warner, New York, general manager, announces. The program for the 2-day meeting includes papers and extended discussions on subjects of major interest to designers and builders of automotive vehicles, to refiners producing fuels and lubricating oils for this equipment and to those servicing and maintaining them.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Next Tuesday

THE oil business has more at stake in the election next Tuesday than any other industry. There is every reason to believe that the reelection of President Roosevelt, backed with the support he is seeking in a new Congress, will mean that this industry, in the immediate postwar period, will be fighting for its life as a free American enterprise.

The trend toward permanent controls of all business over the past 12 years is now commonly conceded. In fact, the administration's spokesmen in this campaign have pointed with pride to its alleged accomplishments in taking over, under one pretext or another, the normal functions of industry. Indicative of what it has in mind for the postwar, it has brazenly claimed that the regimentation of business ended a depression in the thirties and is now winning a war.

This administration's attitude toward the petroleum industry has been apparent from its beginnings and it has never changed. While fearful of the government-business relationship involved, oil operators gave full support to the NRA, starting in 1933. The Madison trial was the industry's reward for this loyalty and support, an abortion of justice which was a forerunner of what was to come.

Since then there has never been a time when one or more branches of the oil business has not been under investigation with the consent of the White House. Many of the industry's leaders, over periods of months, have spent more time defending themselves and their industry of wholly false charges than they have given to the operation of their own businesses.

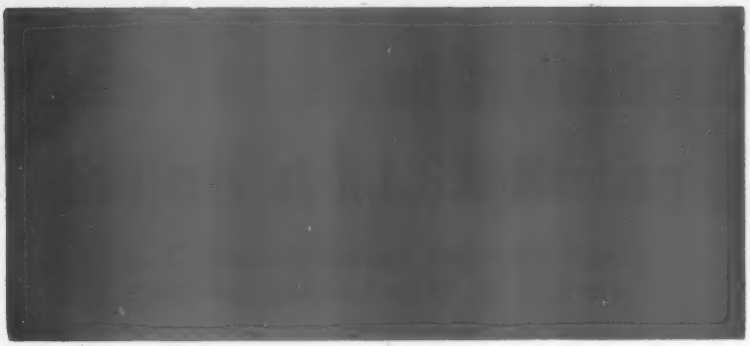
So far as the nation's legislators are concerned these investigations have not been without their benefits. As the case of oil operators was unfolded to them, many senators and representatives have been impressed with the operators' accomplishments and the unfairness of the charges.

But this has not been the case with administrative heads. Persecution by the Department of Justice has been continuous. As a result, the industry's interstate pipe-line system is now largely operated under a consent decree. This was the entering wedge in the program of control. Add to this decree the present government ownership of two big-inch lines and smaller lines and a vast fleet of tankers, and it should be apparent that this administration has what is required to control this industry through its transportation.

Then there is the pending "Mother Hubbard" antitrust case involving most of the principal operating units of the industry and its largest association. These are the companies which before and after Pearl Harbor went to work and through the refining of war products, the building of transportation and a large increase in crude-oil output, saved a war for a Government which entered it wholly unprepared. This suit has been shelved for the duration. Presumably, the reward for this outstanding industrial accomplishment of the war is to be another Madison as soon as peace comes and normalcy returns at the Justice Department.

In foreign policy we have had the Petroleum Reserves Corp. and now the Anglo-American pact. These actions and every other governmental move affecting international petroleum point to a program of complete federal control of the domestic and foreign operations of our nationals.

There is no reason to hope for a change in the attitude of the administration in these and related matters. The conclusion is obvious.



CHICAGO.—Peacetime problems in the preparing and testing of greases in an era of expanding use of machinery, and reports on the wartime job of providing lubricants for the armed forces were the principal topics at the twelfth annual meeting here this week of the National Lubricating Grease Institute.

The new president is B. C. Voshell, Socony-Vacuum Oil Co., Inc., New York, who succeeds William H. Oldacre, D. A. Stuart Oil Co., Chicago. Carl W. Georgi, Enterprise Oil Co., Buffalo, succeeds Voshell as vice president. E. V. Moncrieff, Swan-Finch Oil Corp., New York, was reelected treasurer, and George W. Miller, Battenfield Grease & Oil Co., North Tonawanda, N. Y., was reelected executive secretary.

Among the projects of the Coordinating Research Council, War Advisory Committee, discussed by Walter G. Ainsley, Sinclair Refining Co., were decrease in the number of greases used by the Army, the development of rust inhibiting greases for use on vehicles in storage, of fungi resistant greases for equipment used in the tropics, and procedures for proper application of wheel-bearing lubricant including partial packing of the hubs.

Lt. F. A. Christianson, U. S. Navy, advised grease manufacturers that the Navy does not want proprietary names used in manuals or on containers, and noted that Navy designations are to be used in the instruction manuals. He pointed out the difficulties encountered at supply depots in translating orders for proprietary greases or "short-fiber grease" into Navy designations.

Naval Ordnance lubrication practice has been altered by the war, J. R. Reynolds, U. S. Navy gun factory, informed the meeting, citing the problems in arctic waters where severe cold weather made gun mounts inoperative on account of congealing of the lubricants and spray freezing on greased mating parts.

Grease utilization problems dealt principally with industrial applications. From 75 to 80 blast furnaces now are equipped with centralized lubricating systems, A. J. Jennings, of The Farval Corp., reported to the meeting, in a paper describing lubrication problems on furnaces extending 175 to 200 ft. above ground. Advantages given for centralized systems are accurate control of lubricant to each bearing, reduction in costs, no contamination of lubricants, and the oilers not being exposed to gases.

"Our present interest lies in securing the minimum number of different greases compatible with the best lubrication obtainable for our mechanical equipment," stated Dr. E. M. Kipp, of the Aluminum Co. of America, discussing aluminum rolling mill lubrication. "While we are in sympathy with the goal of the development of all-purpose greases, we are not inclined to sacrifice performance simply in the interests of obtaining a single all-purpose grease."

Six Papers on Test Methods

Test methods and characteristics of greases were the subject of six papers. Adoption of tests showing fundamentals of grease properties was urged in a paper by L. W. Sproule, Imperial Oil Co., Ltd., describing methods for the practical evaluation of lubricating greases. Present tests are used mainly for uniformity of product, the paper noted, and have not much in common with actual usage, and many consumers include field tests in establishing specifications.

A low pour-point oil does not insure a low pour point soda-base grease, reported Carl W. Georgi and John F. O'Connell, Enterprise Oil Co. and Quaker State Oil Refining Corp. Determining factors reported were the type of soda-base structure and the viscosity of the mineral oil.

Other papers on tests and characteristics were "A Machine for Performance Tests on Antifriction Bearing Greases," by P. G. Exline and S. A. Flesher, Gulf Research & Development Co.; "Torque . . . Viscosity Characteristics of Lubricating Grease," by L. C. Brunstrum, E. W. Adams, and E. E. Ziegler, Standard Oil Co. of Indiana; "Separability Characteristics of Greases," by T. G. Roehner and R. C. Robinson, Socony-Vacuum Oil Co., and "Notes on the operation and Application of the S.O.D. Pressure-Viscometer," by J. B. Patberg and J. C. Zimmer, Standard Oil Development Co.

Four new directors of the institute are W. G. Clark, Pure Oil Co., Chicago; H. A. Mayor, Southwest Grease & Oil Co., Wichita; B. G. Symon, Shell Oil Co., New York; and L. C. Welch, Standard Oil Co. of Indiana, Chicago.

Guaranty Bank Will Administer U.O.P. Gift

NEW YORK. — Creation of a trust under which the Guaranty Trust Co. of New York is trustee of securities of the Universal Oil Products Co. of Chicago for the benefit of the American Chemical Society was announced here last week by Dr. Thomas Midgley, Jr., president of the society.

The trust, known as The Petroleum Research Fund, was set up to administer the gift made by a group of oil companies owning securities in Universal, one of the leading research and development enterprises of the country.

The management and operation of the Universal Oil Products Co. will be under the direction of a board to be appointed by the Guaranty Trust.

"The net profit from the Universal Oil Products Co. will flow to the American Chemical Society to be used for purposes of research in the petroleum and natural-gas field," Dr. Midgley said.

"The society will have no obligation in so far as the management of Universal Oil Products Co. is concerned. The society, on the other hand, will have absolute discretion in the matter of selecting the research projects. The society can withdraw at any time it feels that it should not act further and it can then disclaim any interest in the trust."

The donors are Shell Oil Co., Inc., Standard Oil Co. of California, Standard Oil Co. (Indiana), Standard Oil Co. (New Jersey), The Texas Co., and N.V. de Bataafsche Petroleum Maatschappij.

The donor companies made known their purpose to relinquish their holdings of securities of U.O.P. for the benefit of the society at the 108th national meeting of the society in New York on September 13. At that time they offered to give all their securities of the company to the society. The board of directors of the society accepted the offer in principle, and appointed a committee to work out the details. The negotiations culminated in the agreement creating the Petroleum Research Fund with the Guaranty Trust Co. as trustee.

Mississippi-Alabama Oil Group Organized

At an adjourned meeting held Friday, October 27, at Jackson, Miss., representative oil men and business men organized the Mississippi-Alabama division of the Mid-Continent Oil and Gas Association. C. L. Morgan, Dixie Geological Service, Jackson, was elected president of the division. Other officers are: W. F. Vaughey of Vaughey & Vaughey, independent operators, Jackson, vice president, and Burford Yerger of the Mississippi Bankers Association, acting secretary. Fifty directors coming from the oil, banking, investment and land interests were elected.

A committee consisting of the officers and the sponsoring group was appointed to draw up plans for the permanent organization of the division. Headquarters have been established at 508 Capital Building, Jackson. Judge J. C. Hunter, president, and Clarel Mapes, secretary of the general association, assisted in the organization of the division.

California Supervisor To Certify Subsidy Data

LOS ANGELES. — The petroleum branch of the Office of Price Administration and R. D. Bush, supervisor of the California Division of Oil and Gas, have concluded arrangements whereby the state supervisor is assuming responsibility for the certification of the required data necessary to qualify California oil pools for premium payments.

Applicants for premium payments under the stripper well subsidy directive should present supporting data to the State Division of Oil and Gas for certification. Petitions received by the OPA without such certification will be referred to the supervisor before action is taken.

The pools which have already been certified will be brought into line with this procedure so far as geographical limits and well numbers are concerned where that information is needed and not already given.

Stanolind Purchases Dickey Oil Co. Stock

Stanolind Oil & Gas Co., Tulsa, last week consummated purchase of Dickey Oil Co., acquiring daily production of slightly more than 5,000 bbl. Most of the Dickey company's production is situated in Kansas where properties in the Burnett pool alone have daily output of about 2,700 bbl. Stanolind also acquired nine producing wells in the West Edmond pool in Oklahoma along with two drilling operations and two locations ready to drill as soon as rigs can be engaged.

Price paid for common stock of the Dickey company was not disclosed by Frank O. Prior, president of Stanolind, who confirmed the purchase. Earlier, however, negotiations were on a basis of about $6,000,000.

Standard of California, Texas Co. Form Company

SAN FRANCISCO. — Change in the name of American Eastern Petroleum Co. to American Overseas Petroleum Co. was announced here last week.

The company, originally formed last July, manages foreign exploration and development activities of companies jointly owned by Standard Oil Co. of California and The Texas Co. with the exception of their Arabian and Bahrein interests.

American Overseas directs exploration and development of properties in Egypt, New Zealand and Australia, and will include the Netherlands East Indies after liberation from Japan.

Officers of American Overseas are: E. A. Skinner, president and director; E. M. Butterworth, vice president and director; F. C. Sealey, vice president and director; J. H. MacGaregill, director; C. E. Olmsted, director; H. G. Parker, secretary-treasurer, and H. J. Hawley, manager of exploration. Headquarters are in San Francisco.

Ceiling Prices for Pacific Coast Fixed by OPA

WASHINGTON.—Specific ceiling prices for oil products on the West Coast, at the major levels of distribution other than retail sales at service stations, were announced last week by Office of Price Administration. The primary purpose is to facilitate maximum pricing by removing uncertainties concerning ceiling prices on particular types of sales. The new ceilings, effective October 19, will necessitate changes in prices of a few sellers, but the general level will remain as before.

The ceilings, approved by the Petroleum Products Industry Advisory Committee for the Pacific Coast area, follow a field investigation by OPA officials. They cover the following sales by refiners and other distributors in Arizona, California, Nevada, Oregon and Washington:

(1) Tank-wagon sales of gasoline to dealers. (2) Tank-wagon sales of kerosene to dealers and domestic consumers. (3) Tank-wagon sales of P.S. (Pacific Specification) 100 fuel oil and P.S. 200 fuel oil (diesel and furnace fuel oils) to all purchasers. (4) Truck-and-trailer deliveries of P.S. 100 and P.S. 200 fuel oil to all purchasers. (5) Tank-car deliveries of P.S. 100 and P.S. 200 fuel oil to all purchasers.

For the five states in the Pacific Coast area, tank-wagon ceilings are established at the maximum prices of the "reference seller" (Standard Oil of California), while the truck-and-trailer ceilings will be ¾ cent a gallon under the tank-wagon maximum prices. Tank-car ceilings will be 1 cent a gallon under the tank-wagon maximum prices.

OPA said that, since the "reference seller's" tank-wagon maximum prices are on file with the agency and generally known to the trade, and as truck-and-trailer and tank-car ceilings are tied by specific differentials to the tank-wagon prices, its action is equivalent to the establishment of dollar-and-cent ceilings.

Clark and Engineers to Discuss Equipment

Mechanical movement of materials in process is advocated by Ezra W. Clark, vice president and general manager of Clark Tructractor, division of Clark Equipment Co., Battle Creek, Mich., who will discuss materials-handling equipment at a meeting of the Mid-Continent section of American Society of Mechanical Engineers in Tulsa November 17. The meeting will be opened to all interested in the subject. A film originally produced for educational purposes in the armed forces, and recently released for civilian review, depicting modern materials-handling methods, will be the basis of the discussion.

Clark has been associated with the Bureau of Service and Supply and in the fall of 1942 was sent by the secretary of war to make a survey of all the debarkation ports in the United Kingdom, prior to the invasion of Europe. He submitted a report to Washington suggesting the materials-handling methods to be used in this enterprise, thus contributing to the amazing system of distribution operating so efficiently in that theater of war.

Phillips Acquires Acreage

Phillips Petroleum Co. has acquired acreage or exploration concessions in Canada, Venezuela and Colombia in the first few months of its program for becoming an important factor in foreign producing operations. The company has one test well drilling in Canada. These disclosures were made last week in the company's third-quarter report.

To Increase Drilling Material Manufacturing

(Continued from page 42)

sisting the manufacturers in obtaining the materials for the increased facilities and in getting the cooperation of the Army to release the additional machines. Until these new facilities increase the production of tool joints to a satisfactory level, there will be many individual cases of difficulties.

Since it is not possible to get drill pipe or tool joints from other industries; since the quantity is limited by the facilities available; and since all the facilities are turning out the maximum production under present conditions, it is necessary that the best possible use be made of the limited supply until the peak of increased drilling rigs is reached.

"Rock bits are beginning to get extremely critical again, due to the increased demand, but we have already started action to expedite machinery needed for increased production.

Truck Needs Met

"Petroleum operators' emergency needs for medium and heavy trucks have been met by filing applications through regular ODT channels. Practically all of the applications received in Washington have been approved and resulted in certificates being issued authorizing purchase of the vehicles. Currently these authorizations are averaging 1,000 per month. This represents upward of 95 per cent of all applications for petroleum operators that reach Washington. Some applicants are being asked to accept substitutions as to makes at this time. This is necessary for the reason that the entire year's production has been allocated in some of the popular makes.

"There have been 105,000 heavy-duty tires allocated for civilian use from the tire production for October and 110,000 for November. It is of interest to learn that the heavy-duty tire production commencing October 1 is based on a composition of 70 per cent synthetic and 30 per cent crude rubber. Heretofore, the composition for these heavy tires was 35 per cent synthetic and 65 per cent crude rubber. The new tire is now made of a finer grade of rayon rather than the cotton molds and, as a consequence, permits the greater percentage of synthetic. Tests made indicate that the new tire, on the average, for over-all use, will give at least 85 per cent of the wearing qualities of the previous manufacture.

"There are other tight items of equipment for drilling purposes, including tractors, boilers, wire rope, manila cable, bearings, malleable castings, gears, clutches, etc., which we will continue to expedite to meet urgent cases.

"We are now preparing our first quarter 1945 requirements. The supply of raw materials seems a little easier as compared with previous quarters, but the increasing demand of the domestic and foreign PAW petroleum programs will offset the easing of supply. Also, our problems in supply will be affected by limitations in manufacturing capacity to produce critical items of finished equipment and components."

Estimates Raised 85,000 Bbl. on Maximum Rate Of Efficient Production

WASHINGTON. — Estimates on maximum efficient rates of crude-oil production for the United States were revised upward here last week but the industry was warned that capacity output must be maintained until the global war is concluded. Termination of hostilities in Europe, the production division, Petroleum administration for War pointed out, will bring no relief from the current high rate of withdrawals.

J. R. McWilliams, PAW director of production, advised the Petroleum Industry War Council that current crude-oil output exceeds the maximum efficient rate regardless of the upward revisions made possible chiefly by discoveries and development at the Elk Hills field in California and West Edmond in Oklahoma. Current estimates of the maximum efficient rate of production during 1945 are: First quarter, 4,610,000 bbl. daily; second quarter, 4,600,000 bbl.; third quarter, 4,585,000 bbl., and fourth quarter, 4,570,000 bbl. per day.

PAW is making a new survey by districts of the maximum efficient rate of production which may cause slight revisions in the 1945 projections. McWilliams emphasized, however, that the projected rates which are about 85,000 bbl. per day above previous calculations must be fully sustained by completion of 22,000 development wells and 5,000 exploratory wells next year. "Preferably," McWilliams reported, "more wells should be drilled but it does not now appear that the supply of manpower, facilities and materials will permit. Regardless of the termination of hostilities in Europe, requirements for petroleum will necessitate a drilling program during 1945 capable of sustaining the present high rate of petroleum production."

Four geophysical parties were added to the number of exploratory crews engaged in the five PAW districts. Active crews totaled 485 which is believed to constitute a new peak in geophysical operations. There were 286 seismic crews; 130 gravity; 21 magnetic; 47 core drill and 1 Elflex reported active.

An increase was reported in pilot and commercial-scale secondary-recovery operations with many of the wartime operations just now starting to show returns. Continued expansion of secondary-recovery installations was urged and approved by PAW.

DEATHS

J. Cooke Wilson, 65, a vice president of Mid-Continent Oil and Gas Association, president of the Wilson-Broach Oil Co., died October 19 at Beaumont. He was a pioneer in development of the Spindletop field.

Jacob Miller, 21, drilling contractor of Sapulpa, Okla., and Tulsa, died October 20.

G. J. Hendricks, veteran employe of the Ohio Oil Co., died October 22, following a heart attack at Reed City, Mich.

Lt. Frank Polk Coupland, formerly of the land department of Shell Oil Co., Houston, has been reported killed in action in Italy.

Sgt. Gilbert F. Mans, with the former Darby Petroleum Corp., Wichita, Kans., before he entered the armed services, was killed in action in France in July.

T/Sg. Joseph B. Drake, formerly wih the Darby Petroleum Corp., was killed in the French theater of war shortly after receiving his promotion to this rank.

A. B. C. Dague, 70, veteran oil man of Tulsa, and one-time superintendent of operation for Standard Oil Co. at Chanute, Kans., died October 27 at his home. A native of Pennsylvania, he had lived in Tulsa since 1912, which year he joined Gypsy Oil Co. as a scout.

Jules Crawford Cleveland, 41, who had been with Stanolind Oil & Gas Co. in Tulsa for 9 years, died at a Tulsa hospital October 27, following an illness of but 4 days.

A. Guy Jones, 76, retired employe of Skelly Oil Co., died October 27 in a Tulsa hospital, after an illness of about a year. He had lived in Tulsa since 1928, and until his retirement a few years ago had been employed in Skelly's land and lease department.

Mechanics of Producing Oil, Condensate, and Natural Gas

NO. 1 IN A SERIES

ACKNOWLEDGMENT AND SCOPE

Hundreds of men have contributed to the art of producing oil, condensate, and natural gas. The sum of the many individual experiences is petroleum production. Petroleum production may be classified under: (1) mechanics of production, (2) economics of production and (3) operations in production.

This series of articles is concerned with mechanics of production. The manner of presentation is based on the preference of experienced production men who prefer brief and clear statements. This work, therefore, contains a minimum number of qualifications.

Mechanics of production is ultimately a problem of classification. Producers demand that a system of classification yield predictable results. Accordingly, any classification used in this work should be eliminated if some other system is more practical.

Elements of Production Mechanics

*by Park J. Jones**

RESERVOIRS are containers of hydrocarbons of which some are recoverable commercially. Reservoirs also contain interstitial water, anywhere from 5 per cent up to 65 per cent of porosity. Some reservoirs have bottom water. Many have edge water.

The origin of reservoirs is attributed to: (1) Structure including folding, faulting, and salt domes; (2) stratigraphy including unconformity and nondeposition, and (3) lenticularity resulting from changes in lithology or lack of permeability.

The sediments of most reservoirs may be classified as: (1) Sand and sandstones, or (2) limestones and dolomites. The hydrocarbon content of some reservoirs is found, however, in conglomerate, fractured shale, and weathered igneous and metamorphic rocks.

Reservoir Space

A characteristic of reservoirs called reservoir space is defined by the following equation:

$$S = 7758\ a\ h\ f\ (1 - W) \quad \ldots\ldots\ldots\ldots (1)$$

where

a=acreage within productive limits
h=average pay thickness for "a" in feet
f=average porosity for "ah", fraction of "ah"
W=average interstitial water for "ahf", fraction of f
S=reservoir space in barrels.

At the time of discovery all reservoir space is occupied by reservoir fluids. But during the course of production, reservoir space may be reduced by displacement fluids. In other words, at the time of discovery reservoirs contain interstitial water and reservoir fluids, but subsequent to production reservoirs may, in addition, contain displacement fluids.

*Production consultant, Houston.

Reservoir Fluids

Reservoir fluids are classified under reservoir liquid and reservoir gas (See Table 1-1). Reservoir gas is classified as dry, wet, or retrograde. A reservoir gas out of which a reservoir liquid condenses at reservoir temperature upon reduction of pressure is called a retrograde gas. A reservoir gas which is not a retrograde gas, but from which a liquid may be extracted profitably, is called a wet gas. There is no condensation in a wet gas reservoir upon reduction of pressure. A reservoir gas which is neither wet nor retrograde is called a dry gas.

The hydrocarbons which vaporize from reservoir liquids upon reduction of pressure are also called reservoir gases. They may be dry, wet, or retrograde. Primary gas caps may be dry, wet, or retrograde reservoir gases.

Production From Reservoir Fluids

A classification of the production from reservoir fluids is shown in Table 1-1. Natural gas may originate: (1) As dry, wet, or retrograde reservoir gas, or (2) as dry, wet, or retrograde solution gas. Products may originate as wet reservoir gas, wet solution gas, or as reservoir liquid. Condensates are obtained from retrograde reservoir gases. Oil is obtained by separation of solution gas from reservoir liquids.

Displacement Fluids and Mechanisms

During the course of production, reservoirs may acquire displacement fluids. These include: (1) Injected gas, water, and liquid hydrocarbons; (2) encroached bottom water, edge water, and expanded interstitial water, and (3) the gas which may evolve from interstitial water and encroached water. In addition, the effect of reservoir space reduction by compaction of media is included with displacement fluids. In other words, all reduction in reservoir space is attributed to displacement fluids.

Reservoir liquids and gases are producible by virtue of their expansion upon reduction of pressure or by virtue of reduction in reservoir space by displacement fluids. The mechanisms of displacement include imposed and gravity pressure differences, capillarity, vaporization, condensation, retrogration or solution, and diffusion.

Units of Volume

The units of volume are barrels of liquid and cubic feet of gas. Volumes are defined in terms of standard conditions and composition. Standard conditions, SC, are assumed to be as follows: Pressure, 14.73 p.s.i.a.; temperature, 60°F; specific gravity of distilled water, one at SC; specific gravity of air, one at SC.

Composition may be defined (1) by analysis, (2) by separation in a separator, (3) by extraction in a plant, or (4) arbitrarily by the occurrence of fluids in a specified reservoir. For example, it may be specified that gas is methane, ethane, propane, and 30 per cent of the butanes in a specific reservoir gas or liquid. The volume of oil and solution gas in a given reservoir liquid may be defined by specifying a separator pressure and temperature or

by specifying some combination of separator pressures and temperatures if more than one separator is used

Producing Methods

Producing methods will be designated in this work as follows:

A. Declining reservoir pressure
  1. Constant reservoir space . . . Expansion
  2. Decreasing reservoir space
    a. Water encroachment . . . . . Partial water drive
    b. Gas input . . . . . Gas injection
    c. Water input . . . . . Water injection
B. Approximately constant or slowly declining reservoir pressure
  1. Decreasing reservoir space
    a. Water encroachment . . . Water drive
    b. Gas input . . . . Pressure maintenance or cycling
    c. Water input . . . . . Water-pressure maintenance
C. Declined reservoir pressure
  1. Gas input . . . . . Gas drive
  2. Water input . . . . . Flooding
  3. Vacuum on casinghead . . . . . Vacuum

Compressor, extraction, and water plants employed in connection with (1) displacement of reservoir liquid or gas and (2) minimizing surface losses of liquid to gas are considered as part of necessary producing facilities.

A market for residue gas at an adequate price and the availability of gas or water for injection purposes may be significant factors in selecting a producing method.

Operating Methods

Operating methods may be classified as competitive, cooperative, and unit operations. Unit operations refer to unitized royalty and working interests. Cooperative operations refer to the cooperation among producers according to a plan. Competitive operations refer to neither cooperation nor unitization.

Designation and Function of Wells

Wells will be designated in this work as follows:

Designation of wells	Function of wells
Wildcat	To make discoveries
Exploratory . . .	To determine 1. The characteristics of reservoirs 2. The properties of the fluids in reservoirs, and 3. The characteristics of wells
Injection	To displace reservoir liquid or gas
Producing	To produce reservoir liquid and gas

The discovery well is considered as the first exploratory well. The purpose of drilling additional exploratory wells is to determine reservoir and well characteristics and properties of reservoir fluids. These facts are required to formulate operating and producing methods for individual reservoirs and for a field as a whole if underlain by two or more reservoirs.

Barrels of Liquid Originally in Place

The number of barrels of oil, condensate or product in place in a given reservoir at the time of discovery may be generalized as follows:

$$X = S/J \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where
X = barrels of liquid
S = reservoir space in barrels
J = volume factor, barrels of space per barrel of liquid.

According to equation (2), the number of barrels of liquid in a reservoir at the time of discovery is proportional to reservoir space and inversely proportional to a property of fluids called a volume factor. The numerical value of a volume factor depends: (1) On the composition and quantity of hydrocarbons originally in place per barrel of reservoir space, and (2) on how much liquid can be obtained profitably per barrel of reservoir fluid brought to the surface. In the future, probably more of the butane, propane, and possibly some ethane content of reservoir fluids will be classified as liquid.

Ultimate Recovery by Expansion

Reservoir liquids and gases are producible by virtue of their expansion upon reduction of pressure or by virtue of reservoir space reduction by displacement fluids. The rate of recovery determines, probably more than any other factor, what fraction of an ultimate recovery is produced by expansion and what fraction by displacement.

The ultimate recovery of oil by expansion cannot be more than inversely proportional to gas-oil ratios. For example, if oil was produced by expansion with a cumulative gas-oil ratio equal to five times the volume of gas originally associated with 1 bbl. of oil, the ultimate recovery is less than 20 per cent of the oil initially in place. The volume factor for oil at saturation pressure and the abandonment pressure determine how much ultimate recovery of oil by expansion is less than inversely proportional to gas-oil ratios.

The ultimate recovery by expansion for condensate, products, and reservoir gas is defined, aside from condensate and changes in compressibility, by

$$U = 100\ (1 - P_a/P_i) \quad \ldots\ldots\ldots (3)$$

U = ultimate recovery, per cent of fluids in place
P_a = abandonment pressure, p.s.i.a.
P_i = initial reservoir pressure, p.s.i.a.

Ultimate Recovery by Displacement

The ultimate recovery of oil by displacement may be defined as follows:

$$U = I\,D \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

where
U = ultimate recovery of oil in barrels
I = barrels of reservoir space invaded by a displacement fluid
D = barrels of oil displaced per barrel of space invaded.

Equation (4) may be applied to all types of displacement by letting

$$R = I\,D \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where
R = recovery factor, fraction of reservoir fluid in place.
I = invasion factor, fraction of reservoir space
D = displacement factor, fraction of the invaded space.

Invasion factors depend on a number of variables including location of wells and producing rates. Displacement factors determine how much reservoir fluid is displaced from the space invaded by a displacing fluid. Invasion factors are controlled by the mechanisms of displacement.

Basic Principle for Production by Displacement

There are only two fundamental methods for producing reservoir fluids: (1) By expansion, and (2) by displacement. Rates of oil recovery are faster, and ultimate oil recoveries are higher, by the displacement method. There are four ways in which the displacement method may be applied. One, move a reservoir liquid updip with water. Two, move a reservoir liquid downdip with gas. Three, move a reservoir liquid laterally from injection wells to producing wells either with gas or with water. Four, move a reservoir liquid updip with water and downdip with gas simultaneously.

The basic principle in production by displacement, for (1) maintaining the rate of recovery; (2) maximizing ultimate recovery, and (3) minimizing the cost per barrel of recovery, is nonmixing of reservoir and displacement fluids. In other words, produce as much oil as possible without producing either gas or water.

Summary

Summing up, it may be said that production mechanics deal with reservoir space, reservoir fluids, displacement fluids, displacement mechanisms, and with the saving of the liquids profitably extractable from reservoir fluids brought to the surface. The articles to follow will consider these and other elements of production mechanics in detail.

Table 1-1.—Reservoir Fluids and Production

A. Originally in place:
Reservoir fluids are (1) reservoir liquid, and (2) reservoir gas; reservoir liquid commonly contains gas in solution; reservoir gas may be dry, wet, or retrograde.

B. Upon reduction of pressure:
Dry and wet gases expand; retrograde gas expands and condenses a reservoir liquid, reservoir liquid expands and vaporizes a reservoir gas.

C. Reservoir gas when produced:
Wet gas when processed is split into product and residue gas; retrograde gas when processed is split into condensate and residue gas.

D. Reservoir liquid when produced:
Reservoir liquid when passed through one or more separators is split into oil and solution gas; solution gas may be dry or wet; wet solution gas when processed is split into product and residue gas.

Portable Maintenance and Repair Units Prove Worth

by R. B. Tuttle

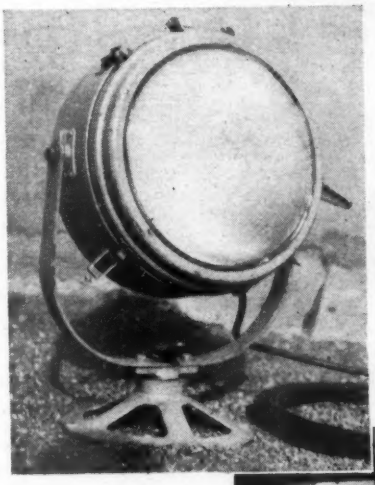
SINCE the introduction of various portable units such as welding and pipe machines and a tool room, the maintenance and repair department of Shell Oil Co., Inc., has shown a substantial reduction in costs for repairing the different units at its Wood River refinery.

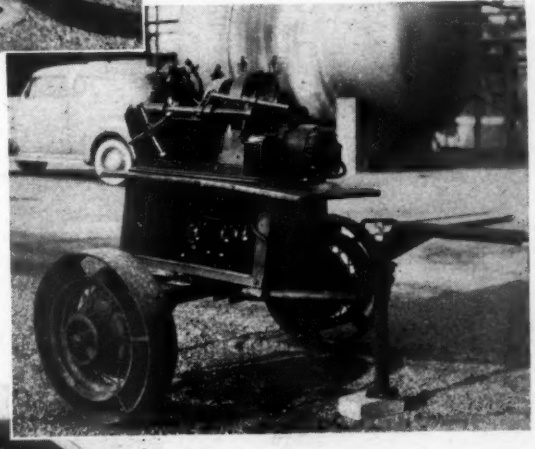
Tools for normal maintenance and for some emergency repairs are moved to the job site in a four-wheel trailer which was built for this special service. Mounted on a chassis which was salvaged from a junked truck the body is built of steel plate similar to the commercial type highway trailer. Windows are located in the trailer side walls. Illumination is with several electric lamps. Standard explosion-resisting electrical fixtures are used in the lighting circuit which is arranged to plug in to any of the 110-volt circuits located throughout the plant. Racks, bins, storage shelves and a desk are built into the body.

Tool-Checking System

The tool-checking system is the same as that used by the central tool room under which the portable unit operates. Various tools from small pliers and wrenches to large pipe tools, including most common tools and some special tools used by the different skilled labor crews, are carried in the portable unit. Because the different skilled-labor crews normally carry enough tools to handle the average job, the portable tool room operates as an emergency tool-supply source. Stocked in the portable unit are such common tools as may be needed by extra crew members or to replace those broken on the job and special tools, not normally taken on to the job by the different crews; all crafts are serviced by the unit.

Repair parts and material supplies for the different crews are delivered at 20-minute intervals from a central warehouse. A representative from the central warehouse is located at the job site for the purpose of keeping the repair and maintenance crews supplied with materials. Duties of the warehouse representative are to contact the job supervisors relative to their material requirements, notify the central warehouse by telephone what materials are needed and to handle all field book work concerning material transfers. Telephone calls made by the representative to the central warehouse are timed to tie in with the 20-minute truck delivery schedule.





Above: Portable floodlights are moved from one location to another on the job. Right: Power-driven pipe machine, mounted on frame with salvaged truck wheels. Below: Four-wheel trailer made from salvaged materials

Lighting System

Ample lighting of the work areas for the night crews is carried out with portable floodlights which may be moved to any location on the job as desired. Several standard heavy types of floods are used in portable service.

Included in the group of portable tools are several standard-make power-driven pipe machines, each mounted on a frame with two salvaged truck wheels, leveling jacks and a trailer hitch. These units are moved from job to job and to any desired location on a job.

Mounted upon a 1½-ton truck which is no longer roadworthy, a gasoline-driven arc welder and acetylene equipment provide portable welding and cutting equipment. Six such units are in constant use through the plant in all kinds of maintenance and repair work.

The over-all maintenance and repair picture at the Wood River refinery shows that the use of portable tools and equipment results in substantial time-saving over ordinary methods.

then he said to himself

"I'M SITTING TIGHT"

REPLYING to America's early proposals and assurances that the United Nations had no designs on Spanish territory, Dictator Francisco Franco defended his neutrality with:

> "I will avoid anything which might disturb our relations in any of their aspects."

Sitting tight in any business is one of the easiest things a man can do.

The only trouble is that in this era of quick advances, sitting tight doesn't get one anywhere—but down—and fast.

And when the dust of the passing parade clears—it's a long, plodding process to catch up.

We see it well expressed in many "Stand pat" companies now making *no* plans for improving their welding methods—either in new production techniques or the latest welding equipment.

And others . . .

High Pressures and Salt-Water Flows Controlled in Deep Coastal Wells

by Neil Williams

Drilling practices directed toward keeping mud in proper condition and maintaining circulation rates sufficiently high to insure reasonable progress in making hole and prevent hazard of sticking pipe

ABNORMALLY high gas pressures and salt-water flows continue among the chief hazards of deeper drilling on the Gulf Coast. As deep development spreads and occurrences of these conditions become more frequent, increased importance is attached to the problem of control. With prospects of drilling being extended to constantly greater depths where relatively higher abnormal pressure can be expected, adoption of practices and provision of facilities which will safeguard operations at these levels and insure successful completion of holes are being sought.

The combination of high pressures and salt-water flows encountered in many instances presents unusually difficult conditions to control. In these cases, the salt water acts to contaminate the drilling mud, which allows the gas to aerate and lighten it, and thus make control of pressures impossible. Usually, excessively high temperatures prevail further breaking down the effectiveness of mud treatment to prevent contamination by salt water.

Loss of circulation in uncased porous and permeable formations when mud weight is built up to overcome abnormal pressures is one of the major resulting hazards. In many areas pressures have been encountered which could not be controlled with less than 17 to 18-lb. mud. In some instances, heavier mud has been required. With mud of this weight, formations not carrying the excessively high pressures are readily broken down, and take the mud in varying quantities according to their pressure resistance and porosity and permeability.

Excessive pressures and salt-water flows occur mostly at depths below 9,500 ft. Operators now generally follow the practice of cementing an intermediate protection string of casing just before drilling into expected troublesome zones, usually at a depth of from 9,000 to 9,500 ft. This precaution affords protection for the shallower, lower-pressure formations down to the casing points, but intermediate formations of relatively low pressure below the pipe still offer opportunity for substantial loss of returns as mud weights are built up.

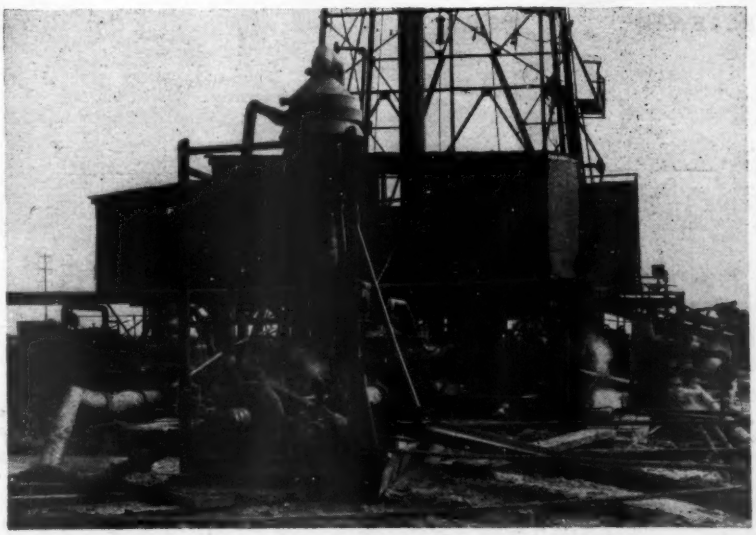
Additional problems are faced in keeping the hole in good condition and preventing sticking of pipe. Higher rates of water filtration and loss of circulation which might result as mud weights are built up to control pressures are conducive to rapid accumulations of filter cake on the walls. In shales the water filtration accelerates deterioration of the formation, causing sloughing and caving, which in turn results in accumulation of cuttings and bridging if adequate precautions are not taken. Possible gas cutting, and contamination of the mud by salt-water infiltration also reduces the effectiveness of the mud and complicates treating and conditioning.

In combating these complications, two phases of drilling are receiving particular attention. These are: (1) Keeping the drilling mud in proper condition, and (2) maintaining circulation rates high enough to insure reasonable drilling speeds and to keep the hole clean.

Increasing emphasis is being placed upon reducing the filtration rate of the drilling mud. Especially for drilling at depths below 9,500 ft., most operators seek to use a drilling mud having a filtration rate of not more than 10 cc. Generally, for such depths it is considered desirable to run with a much lower water loss. For depths above 9,500 ft. it often is possible to use muds with higher filtration rates, generally from 15 to 20 cc.

Caustic and quebracho treatment is being used in most deep wells to control water-loss properties of mud, although it often is necessary to employ bentonite or starch products. Particularly effective results are being attained with the latter and increased application is being made of it. More use also is being made of sodium silicate, replacing water-base muds, where shale conditions and salt water flows and pressures are especially bad.

With sodium silicate, water loss theoretically is zero as no fresh water is present in the mixture. It is mixed with brine and is not affected by salt-water infiltration. In the control of pressures, much higher weights are obtainable with low viscosity and gel rate than are pos-



Centrifuge installations used to assist in mud-weight control on high-pressure well

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Quarter-turn Double Disc Gate VALVES

Especially designed for EASE OF OPERATION *IN ANY SERVICE!*

- Positive position indication at all times.
- Quarter turn operation for instant service.
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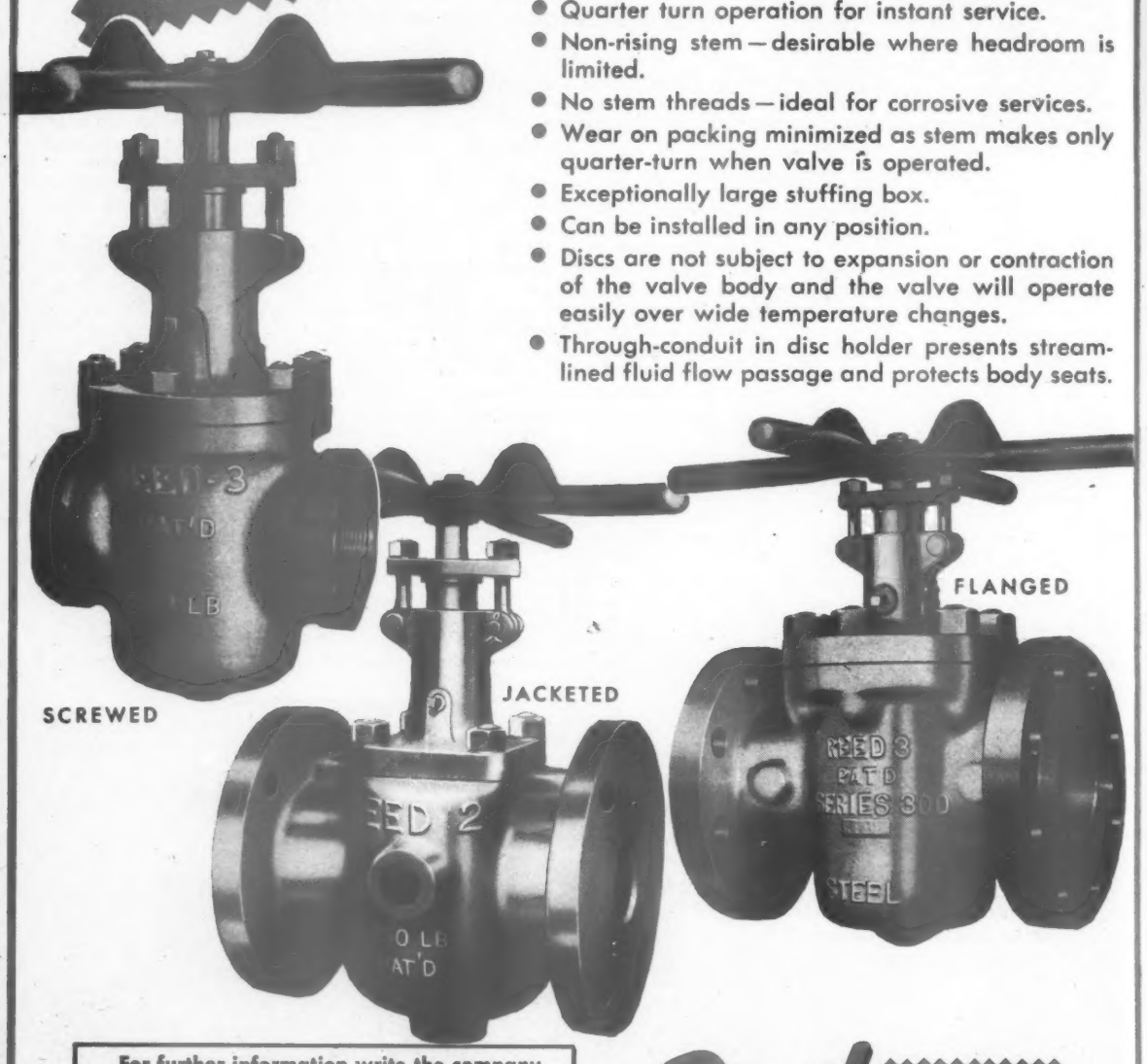
- Wear on packing minimized as stem makes only quarter-turn when valve is operated.
- Exceptionally large stuffing box.
- Can be installed in any position.
- Discs are not subject to expansion or contraction of the valve body and the valve will operate easily over wide temperature changes.
- Through-conduit in disc holder presents streamlined fluid flow passage and protects body seats.



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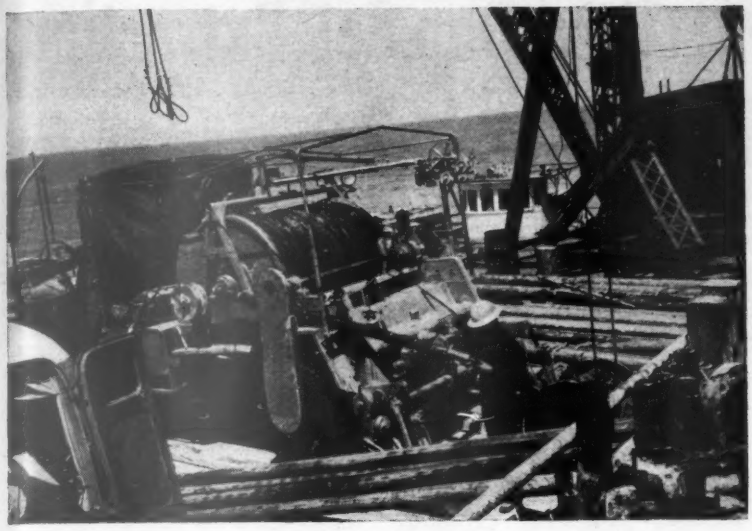


Preparing to run survey in deep, high-pressure well on a Coastal water location

sible with water-base muds but it contains a much lower suspended solid content.

Circulation rates are a function of pump speeds and pressures. To insure adequate circulation rates under all contingencies, at least two large pumps are employed on all rigs operating in deep, high-pressure areas. Most rigs, for this type operation, are provided with three such pumps, making available two pumps at all times for regular circulation with a spare for mixing mud and for alternate use or standby duty. Ordinarily at least one of these is of 20-in. size, and in many cases two of them are.

For drilling down to depths of from 5,000 to 6,000 ft. many operators follow the practice of operating two pumps in parallel, giving added volume of circulation where higher pressures are not needed and allowing for the larger hole and normally faster drilling at the shallow depths. Most effective results usually are obtained with pumps run at 20 to 25 s.p.m. and 850 lb. discharge pressure. At greater depths where higher pressures are required to maintain satisfactory circulation rates, practice generally is to operate two pumps in series. Under normal conditions it has been found by some operators that better drilling progress can be maintained and the hole kept in better condition if the pumps are run at speeds of from 30 to 35 s.p.m., building up discharge pressure of 1,200 to 1,500 lb.

In a number of instances, pumps have included a 20-in. triplex unit. One deep-drilling rig now running has such a pump with two additional 20-in. duplex pumps, all for mud circulation. Regular operation of this pump in series with one of the duplex pumps provides for circulating discharge pressure of about 2,300 lb. On this rig additional smaller pumps are provided for mud mixing and other auxiliary service.

Mud control where abnormally high pressures are concerned usually involves the necessity of extremely close balance between mud weight, viscosity and pump pressure. The margin between the critical pressure at which the formations will take the drilling fluid and that required to control the formational pressures and salt water flows ordinarily is very slight. Frequently, mud weights may have to be held to within a range of 0.1 to 0.2 lb. Increasing the viscosity of the mud often will permit some reduction in weight of the mud, and vice versa, but an improper balance of these two factors within definite limits may result either in salt water or gas infiltration into the system and possible well blowout, or loss of mud into the formation.

To insure accurate and uniform control of mud weights, continuous mud weight testing and recording devices are finding increasing use. Other precautions being taken include use of mud-pit-level measuring gages which indicate any increase or decrease in the volume of mud in the system. Infiltration of salt water flows into the system or gas cutting and lightening of the mud would be reflected by an increase in mud level in the pits. Vice versa, any loss of fluid into the formation would be indicated by a lowering of pit level.

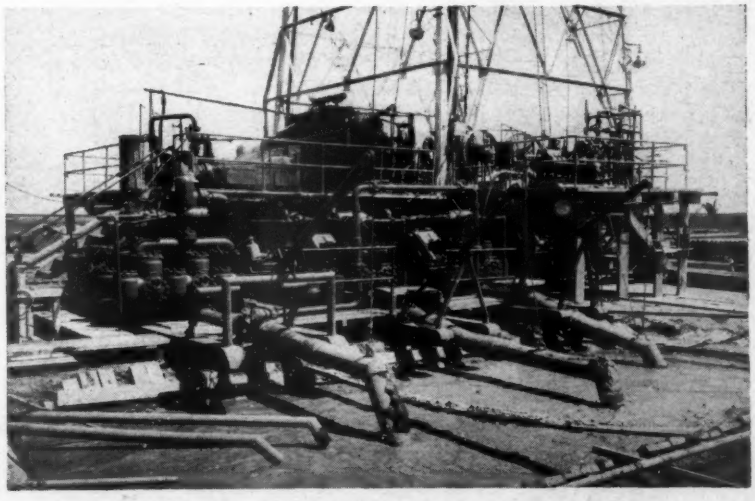
Chemical Storage Data Presented in Bulletin

"Physical Properties Pertinent to the Storage of a Number of Commercially Important Liquids and Gases," published by the Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa., and Des Moines, Iowa, fellowship donor, has been made available recently for convenience of engineers.

The publication was prepared by James B. Gardner, Ludwig Adams and Robert M. Stuchell of the Chemical Storage Fellowship at the Mellon Institute and is designated as Bulletin 7.427-B.

Between 40 and 50 of the 91 substances listed in the bulletin are common to the petroleum refining industry. Eight charts showing specific heat versus temperature relationship of 33 substances, a page of conversion factors and a reference list complete the 24-page bulletin.

Nineteen different physical properties are listed in the tabulated data.



Rig using 20-in. triplex and two 20-in. duplex pumps for control of high pressure

New Lube Plant Uses Duo-Sol Extraction, Benzol-Ketone Dewaxing Processes

by Arch L. Foster

A five-unit lubricating-oil plant started operations a few months ago, producing modern lubricating oils, aviation and/or motor oils, from Mid-Continent and Gulf Coast crudes. The plant includes vacuum feed preparation, Duo-Sol solvent extraction, MEK-benzol dewaxing, clay filtration and vacuum rerunning, and modern blending units. The solvent-extracted, solvent-dewaxed oil is vacuum rerun and clay filtered in a combination unit which permits wide flexibility in operation and product specifications.

COMPLETING a new, ultramodern lubricating-oil plant at its Marcus Hook refinery, Sun Oil Co. is now operating one of the most up-to-date factories for making lubricating oils for motor and aviation engines and other equipment requiring the ultimate in lubricating-oil qualities, according to officials of the company. This new five-unit plant charges a maximum of 14,600 bbl. of reduced crude per day, obtained from Mid-Continent and Gulf Coast sources.

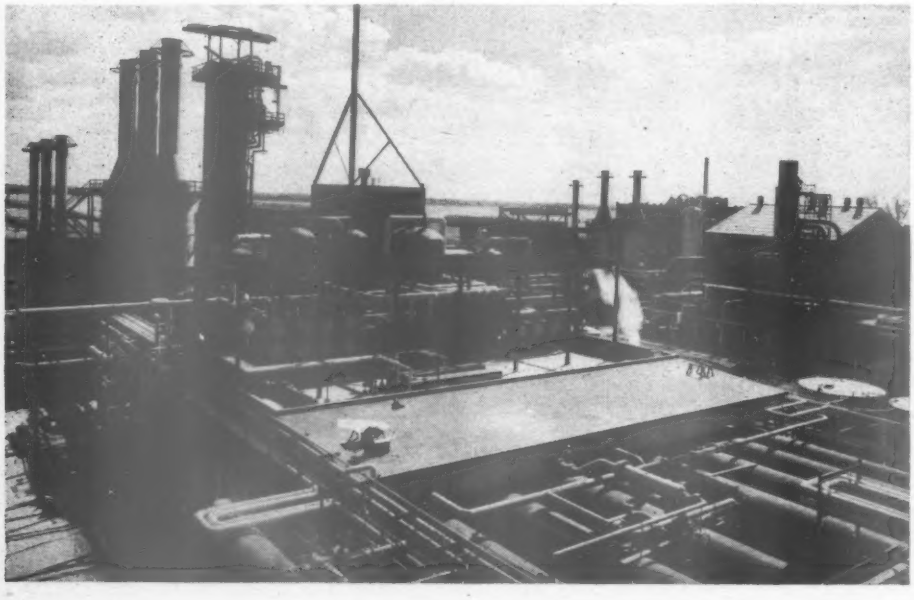
The new plant includes the vacuum distillation unit for charge-stock preparation; solvent extraction operating as Duo-Sol process on the vacuum-reduced crude; methylethyl ketone - benzol solvent - dewaxing unit to remove paraffin waxes from both bright stocks and neutral fractions; filtration and vacuum distillation facilities for the solvent - extracted, dewaxed fractions, and a blending-shipping division.

Realizing the probable variation in available stocks, and in demands of other divisions of the refinery for stocks of different kinds, this entire plant has been designed with the maximum flexibility in type and properties of charge stock, and in operating variables. This is especially true for stocks varying in the specifications of pour point, flash, fire points, viscosity and viscosity indices and other properties which affect both the operation of the plant and the qualities of the products. To iron out the operations of the plant when composition and properties of the charge stocks may vary widely, surge tanks of large capacity are placed between units; these tanks permit a unit to complete all of one quantity of charge on hand before starting on a new-type charge, even though an earlier unit in the continuous process may already be operating on the new, possibly radically different stock.

The entire plant operates under control of a central laboratory; an interunit communications system permits operation of the whole assembly by one supervisory group.

Charge Stock Preparation

The raw reduced crude is received in the plant from four units, topping units in the main refinery, and the combined stream may be composed of any combination of proportions of these four streams. The demands on the charge-stock preparation unit vary according to the product being made. In making aviation lubricating oils, to which the efforts of this whole new plant will be directed during the war period, it will be necessary probably to operate all four units to produce the 14,600 bbl. of stock daily. When making motor oils this requirement will be less severe. The reduced crude reaches the vacuum unit at temperatures around 250° F., coming from exchangers. Here, as elsewhere, a large surge tank is required to compensate for wide possible variations in the output of each unit, the reduced crude coming from the bottoms of the towers which are handled on a bottom-level controlled



Bird's-eye view of three units in Sun Oil Co.'s new 7,000,000 high-grade lubricating - oil plant at Marcus Hook, Pa., showing the Duo-Sol extraction unit, in foreground; Petro-Chem furnaces of this unit in left background; vacuum fractionating tower of Filtrol fractionation and rerun unit, just right of furnaces; filter pump house building (with vent stack on top) of Filtrol fractionation-rerun unit; in right background, the MEK-benzol dewaxing unit

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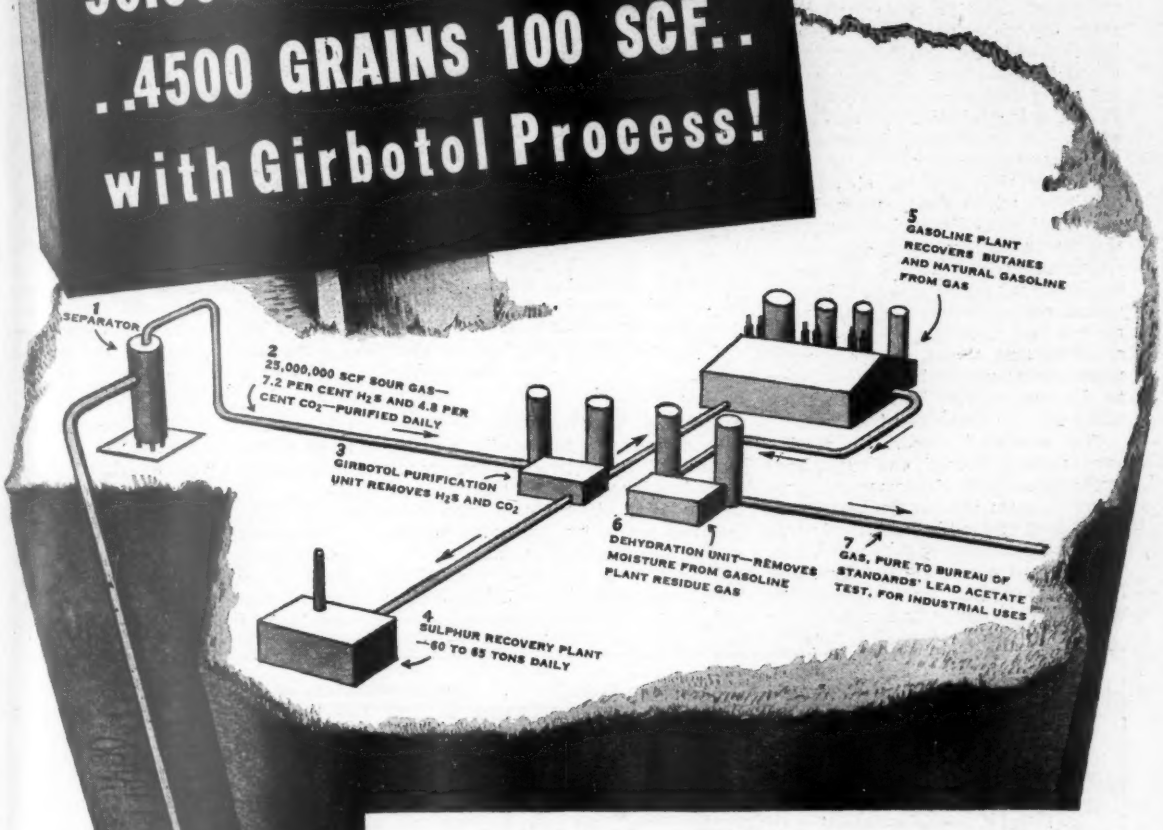
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6 DEHYDRATION UNIT—REMOVES MOISTURE FROM GASOLINE PLANT RESIDUE GAS
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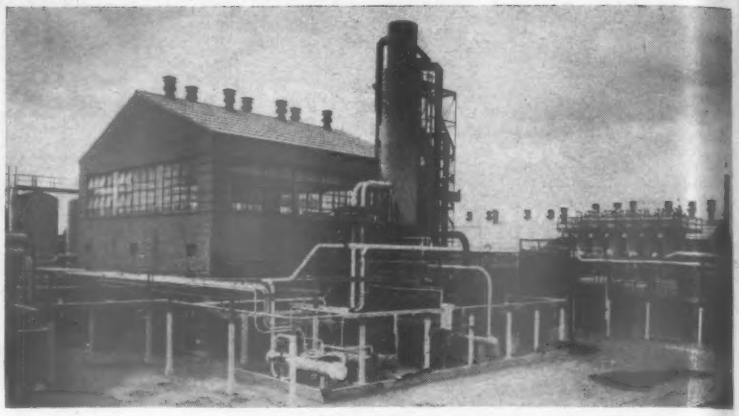
type of operation. The vacuum unit charge pump takes suction from this large surge tank.

The stream from this charge pump is split, one portion passing through vapor heat exchangers atop the vacuum fractionator, the other exchanging with the same tower bottoms, the proportions being so controlled, manually, that the two streams exiting from the exchangers have about the same temperature. Entering the furnace coils at about 460° F. and being raised to about 715° F. at the coil outlet, this charge enters the vacuum tower, where the too-light material, gas oil, etc., passes overhead, while the heavier, lubricating-oil stock is withdrawn from the tower bottom, each stream exchanging with incoming charge as outlined above. Stripping steam is introduced into the tower bottom to reduce the bottoms to flash-point specifications which is the control point of the unit. The bottoms pass to the surge tanks which are stock tanks for the Duo-Sol unit.

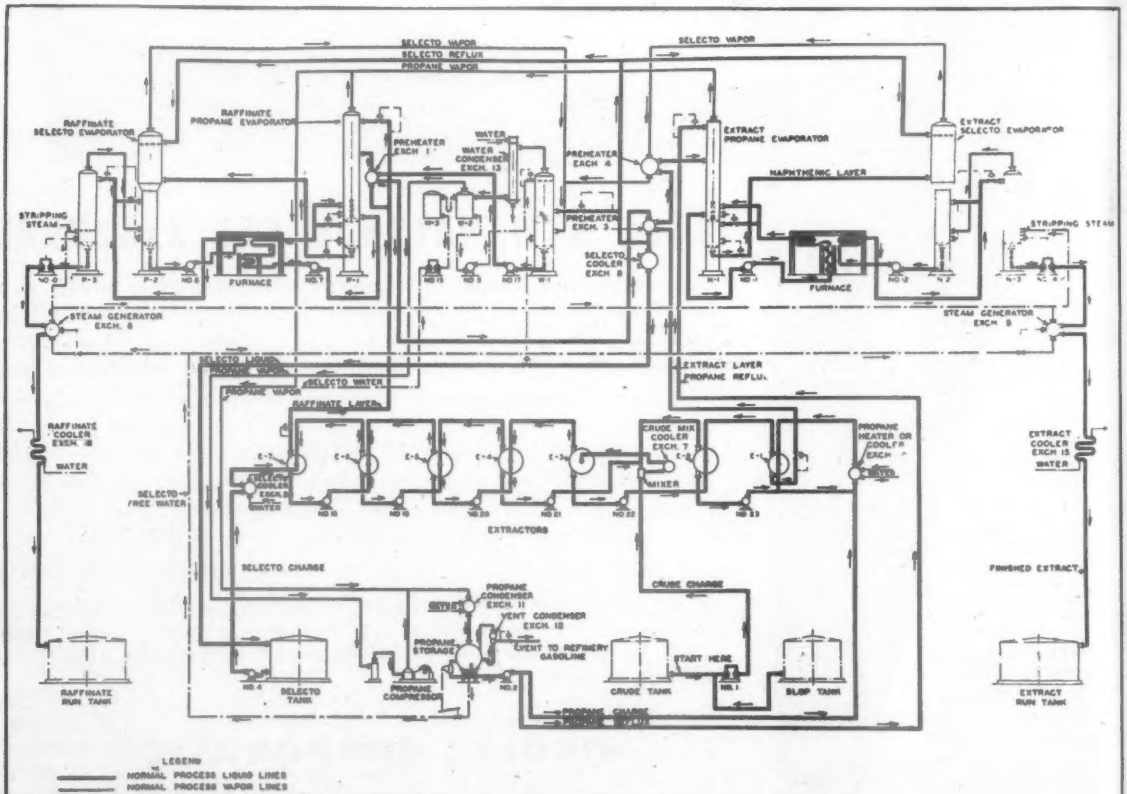
The overhead vapors from this vacuum unit through the vapor heat exchangers and the vacuum condenser, steam and uncondensed vapors being ejected by means of barometric condensers and vacuum jets. Two gas-oil streams are taken, one from the vapor exchanger from which reflux oil is taken, and one from the water-cooled condenser. When producing motor oils the composite of these two streams meets specifications for fresh gas oil; making aviation oils the combined overhead is too heavy for fresh specification gas oil, and is suitable only for heavy oil thermal or catalytic cracking stock. By withdrawing a side stream from this vacuum tower, taking out there the heaviest overhead material, a suitable gas oil is produced from the overhead vapors.



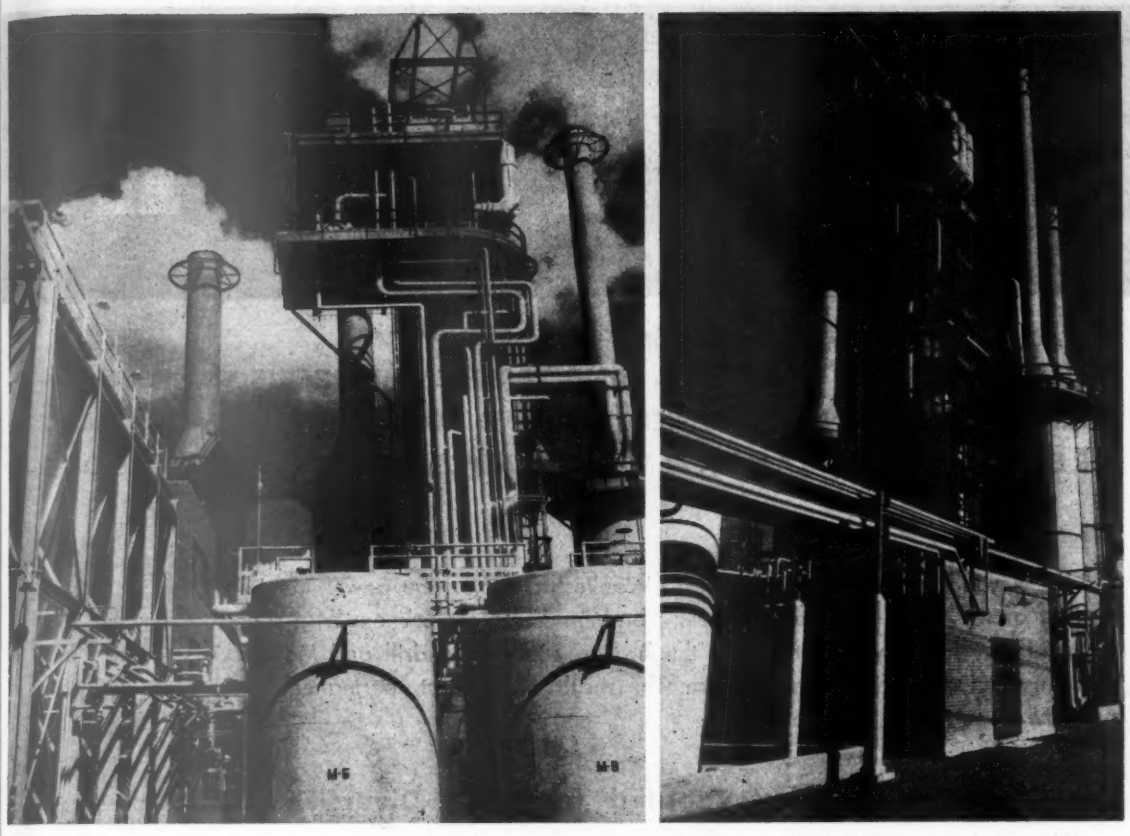
This view shows firing building in left foreground, with solvent tank in rear. In center is the MEK-dewaxing unit combination pump-house-filter building, with four compartment flue gas and filter feed tanks next and flue-gas holder to the right. Also shown are the cold solvent flue gas and slack wax exchangers and chillers, and ammonia condensers and chiller compressor building

Solvent Extraction Treatment

Because of necessity for uniformity of properties of Duo-Sol charge stock in order to produce a uniformly high-quality extracted oil, two 24,000-bbl. surge tanks are pro-



Flow chart of extraction and solvent-recovery steps at Sun Oil Co.'s new plant



Left: Closeup of rundown tanks (center foreground) and super Filtrol storage bin of the Filtrol fractionating and rerun unit. In center background is the fractionating tower for unit and behind it the furnaces for the Duo-Sol unit. Right: Closeup of pump house, fractionating tower and furnaces of the Filtrol fractionating and rerun unit

vided; into these the charge stock streams are discharged, and thus by blending variant streams inequalities in properties are averaged to reduce to a minimum the fluctuation which interferes seriously with the final product's quality uniformity. The selective solvent in a blend of liquid propane with a solvent named Selecto, which is composed of varying proportions of phenol (carbolic acid) and cresol, another coal-tar product. This last combination may be varied considerably, depending on the properties of the charge stock and on the qualities desired in the finished oil.

The Selecto solvent shows a specific gravity of about 1.05, that of liquid propane is 0.509, which difference in gravity aids in the separation of the two components or fractions. The reduced crude is separated by mixing it with the solvent into two immiscible layers, one layer containing the more highly paraffinic constituents of the original charge, dissolved in propane. The more naphthenic, undesirable portions of the charge are dissolved in the Selecto portion of the solvent mixture, this portion having a high solvent power for naphthenic and other nonparaffinic hydrocarbons as compared to the paraffinic portion which is more soluble in the propane. The addition of the propane to the mixture not only makes the paraffins-propane solution less soluble in the Selecto solvent, but increases the difference in specific gravity, facilitating and hastening the separation of the two immiscible layers. These two layers separate in settler tanks, with the heavier Selecto solution on the bottom.

In operation, the charge stock at 100°-130° F. is introduced into the mixer-settler system under some 300 lb. pressure, sufficient to maintain the propane in liquid form. This stream enters between extractors 2 and 3; the propane charge has contacted the extract-Selecto stream in extractors 1 and 2, and then joins the fresh charge in the mixer between extractors 2 and 3 as stated above. The Selecto portion of the dual solvent system is introduced into extractor 7 where it mingles with and extracts naphthenes and other nonparaffinic hydrocarbons from the propane-raffinate (paraffinic) stream passing countercurrently. By thus washing continuously the raffinate, highly paraffinic layer with fresh Selecto to remove the last practicable traces of naphthenic material, the paraffinic product is more nearly free of undesirable nonparaffinc hydrocarbons; analogously, by washing the Selecto dissolved extract with fresh propane which enters at the point where the extract leaves the system, the last traces of paraffins tends to be washed back into the system to join eventually the paraffinic fraction.

The proportions of propane to charge stock is normally about 2 or 3 to 1; for Selecto, the ratio ranges from 4:1 to 6:1. Since some of each solvent remains in the other layer, it is necessary to provide two assemblies of heaters and fractionating towers to separate solvents from both extract and raffinate. Common condensers are used, the propane vapors from each tower passing to one recovery condenser while the Selecto vapors from each assembly are led to another condenser, from which recovered solvent in each case is returned to stock tanks. Steam is used to strip the higher-boiling Selecto from the extract and raffinate fractions. The steam is condensed and led to the process steam generator which is returned to the system, thus reducing further the loss of solvent.

The extract is disposed of, for ex-

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COLD REPAIR PROCESS SAVED THIS BROKEN CASTING

BROKEN 6-LRO WAUKESHA FRAME

Broken end was cut off and replaced with salvaged good end from another frame. Repairmen shown in photo—Earl J. Reynolds and G. B. Reardon of the Eureka Tool Co., Oklahoma City. They accomplished this unbelievable repair for the Arrow Drilling Co. of Tulsa, Okla.

SAME FRAME AFTER METALOCK REPAIR

The white line shows where the new frame end was Metalocked in place. After the repair, a feeler's gauge would not slip between the frame and pan. Metalock, Masterlock and Metalace cold processes were used in completing this amazing money-saving repair.

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ample, by cutting it back with some low-viscosity product such as a gas-oil fraction, to meet Bunker C fuel oil specifications, it containing the heavy, naphthenic and asphaltic products. The raffinate is highly paraffinic, and passes to the dewaxing unit with practically all the wax contained in the original reduced crude.

Wax Removal

The essentially solvent-free raffinate is mixed with a dewaxing solvent in proportions of about 3 of solvent to 1 of oil. This solvent, the now-familiar MEK-benzol solvent, so-called, is composed of a mixture of benzol and toluol with a ketone such as methylethylketone—MEK—in proportions which may be varied widely, the composition depending on the composition of the charge stock, the percentage of type of waxes present and the general solubility considerations of the charge as well as the final specifications desired for the dewaxed oil. The solution is cooled first in water-cooled exchangers, later by passing in exchange with cold filtered oil solution, and finally the wax is crystallized in scraped exchangers against ammonia as refrigerant at —20° F. The oil solution with its suspended crystallized wax then passes to the rotary drum filter, where the solid wax is removed, and washed with a solvent such as naphtha. Oil and solvent pass to receivers, then to the recovery system where the solvent is heated and distilled off, stripping the last traces out with steam which is refractionated to recover the ketone-benzol solvent.

Super Filtrol storage bin, rundown tanks and fractionating tower

Provision is made in the plant to macerate the wax and so to remove the retained oil which is recovered, as is solvent retained in the wax.

Finishing Lubricating Oil

Much of the flexibility of treating and of product specifications is built into the rerun-filtration combination units. A vacuum rerun unit is provided; when making aviation oils, the specifications for which are very severe, this unit removes small amounts of light oils which may be present and which if present will affect adversely the oil stability and its flash-fire points. This distillation capacity is used, when making motor oils, to take off-side streams of oils of the SAE 10, 20, and 30 grades, and to yield filtered bright-stock bottoms, used for blending other grades and types of lubricating oils.

In normal practice the charge is heated to about 265° F. and split. About 15 per cent is used to make up a 10-lb. per bbl. slurry with Filtrol clay, this slurry being added to the main oil charge at the point where the whole enters the furnace coils. Temperature in the coil is raised to that required to distill off the amount of light ends desired; the unvaporized oil mixed with the clay is picked up by a slurry pump from the tower bottom and feeds into an Oliver rotary drum-type precoat filter which removes the clay at 300°-400° F. The filtered bottoms flow to a receiver, to a cooling coil and to storage as finished bright stock or aviation lubricating-oil stock. The overhead light fractions, whatever the operation may be—that is, for aviation stocks or for motor-oil side streams plus bright-

(Continued on page 74)

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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Overheating of Centrifugal Pump Motor

We have a pump that causes its motor to run hot and it once burned out. What is the theory for this?—F.C.B.

Centrifugal pumps can operate through a wide range of capacity and head. At low capacities (high head or pressure) the amount of power required is small. As the capacity is increased (head decreases) the power required grows larger and larger until at some very high capacity the efficiency of the pump becomes so poor that little power is required. This is indicated by the characteristic curves shown on this page.

Such curves are usually based on water and hence if some other fluid is being handled the power required will be less and in direct ratio to the specific gravity of the fluid. Thus if a 0.7-specific gravity oil (at operating temperature) is being handled, the power required will be only 70 per cent of the values shown on the curve.

Power requirement can be reduced by decreasing the impeller size (also by using a lower speed) but the head that the pump will produce also decreases. The effects of impeller size on the performance of the pump are approximately as follows:

Capacity changes directly with size.

Head changes as the square of size.

Power changes as the cube of size.

Thus, for the pump characteristics shown on this page the 4-hp. motor can be relieved by cutting the impeller size down from 5 in. to 4½ in., as follows:

(1) At 160 g.p.m.—
New g.p.m. = 4.5/5 × 160=144 g.p.m.
New head = square of 0.9 × 33=27 ft.
New power=cube of 0.9×5.8=4.2 hp.

(2) At 100 g.p.m.—
New g.p.m. = 0.9 × 100 = 90 g.p.m.
New head = 0.81 × 75 = 61 ft.
New power = 0.73 × 5 = 3.65 hp.

If a 0.7 specific gravity material were being handled, even a 3-hp. motor would be satisfactory.

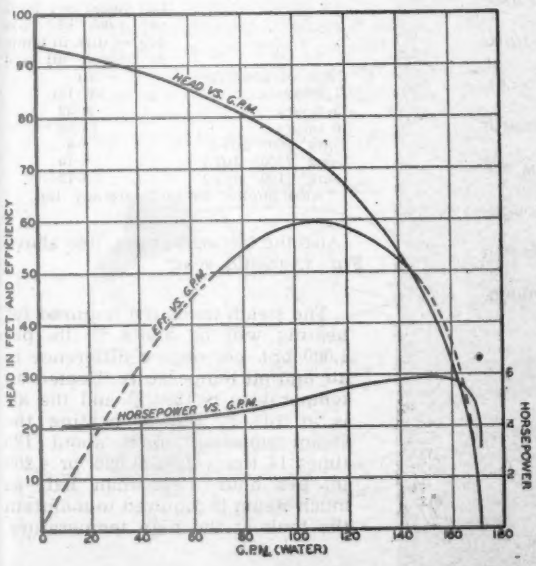


Fig. 1: Characteristic curves of a centrifugal pump with 4 hp. motor and 5-in. impeller

Definition of Octanol

May I respectfully ask you whether you could give me a hint where to find something in writing pertaining to the characteristics (and analyses) of octanol?—J. K. D.

Octanol is the recommended name of octyl alcohol. The Commission and Council of the International Union of Chemistry adopted this manner of naming alcohols, and their report is published in the Journal of the American Chemical Society, 55, 3905 (1933). According to this report the name of alcohols and phenols is made up by attaching the suffix "ol" to the name of the hydrocarbon to which the alcohol group (OH) is attached. Thus, the names of alcohols become:

Hydrocarbon	Alcohol: Older name or formula	Alcohol: New name
Methane	Methyl alcohol	Methanol
Ethane	Ethyl alcohol	Ethanol
Ethane	$CH_2 \cdot OH \cdot CH_2 \cdot OH$	1,2-Ethanediol
Naphthalene	$C_{10}H_4(OH_4)$	Naphthalenetetrol
Octane	$C_8H_{17} \cdot OH$	Octanol
Octane	$C_3H_7 \cdot CHOH \cdot C_4H_9$	4-Octanol

There are obviously many possible kinds of octanols (8 carbon-atom alcohols) and it is possible that the name octanol has been used in a general or careless way, or the author that used the term may not have been aware of which particular octanol constituted the material he was describing.

Tower Back Pressure

In your pages of March 30 and April 27, 1944, you show pressure drops through vapor lines and condenser-box headers for a 59 A.P.I. gasoline. Our tower operates at different conditions and are your pressure drops much in error when used for a 220° F. top temperature and a light aviation gasoline?—A.N.

The pressure-drop values referred to are not greatly affected by the kind of gasoline being handled but differences in tower pressure may be important. Here are correction factors to be used with pressure drops published on the Questions on Technology page of March 30, April 27, and also May 18, 1944, by which other materials than gasoline and other tower pressures can be handled. The factors should be used as multipliers for pressure drops that are related to velocity, but they should be used as dividers for pressure drops related to pounds.

	A.P.I.	Factor
Light gasoline	68	0.9
Regular gasoline	59	1.0
Kerosene	43	1.35
Light gas oil	38	1.45
Heavy gas oil	34	1.55
Pres. distillate (55 lb. abs.)	56	3.0

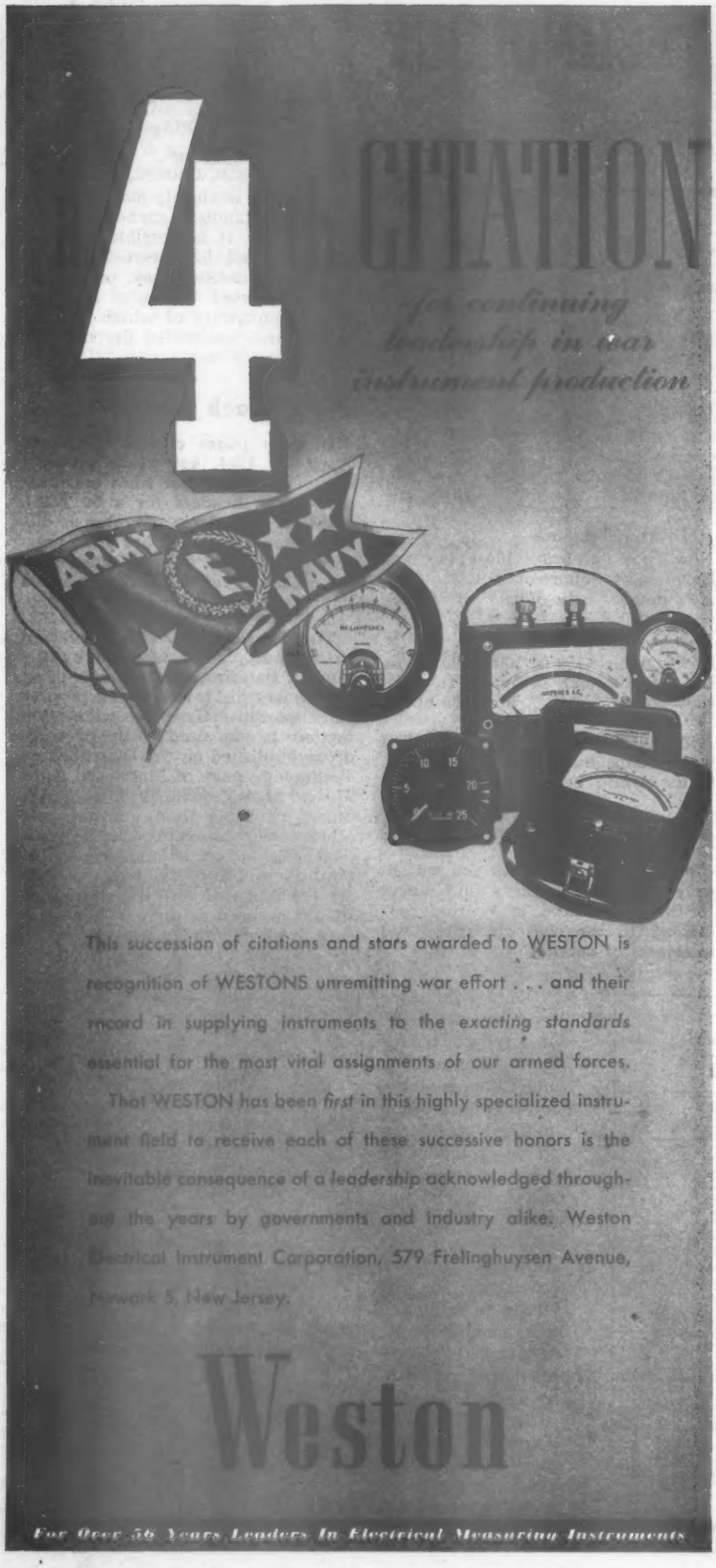
These factors were determined and may be determined for other special cases by the use of the following formula:

$$\text{Factor} = 0.4 \frac{MP}{T}$$

in which
T = Vapor temp. (°F. + 460)
M = Mol. wt.
P = Abs. press. (lb. ga. + 14)

Although the effect of pressure is cared for by this equation, its important effect should be emphasized. For example, pressure drop is affected by tower pressure as follows:

Pressure, lb. sq. in. Gage	Pressure, lb. sq. in. Absolute	Factor
0	14	0.78
4	18	1.0
10	24	1.33
15	29	1.61
20	34	1.89
30	44	2.44
50	64	3.56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Sun's New Lube Plant

(Continued from page 70)

stock bottoms—are condensed as gas oil.

One of the advantages of this type of operation, say company engineers, is that, while the filter clay remains in the mass of oil in the tower bottom, it holds in adsorbed condition heavy undesirable, high-molecular-weight materials which otherwise, in the absence of the clay, would pass overhead in an amount small in total quantity but sufficient to discolor and damage seriously the properties and specifications of the overhead distilled products. Or, if conditions are controllable to eliminate this difficulty, these bodies will continue with and reduce the quality of the heavy stock below the point where premium quality oils can be made from it.

The various fractions produced as outlined above are segregated in different rundown tanks. Homogenizer mixers and meter-controlled streams of different products are blended in conventional, very modern and exacting practice to make whatever products are required to meet demands, either for war products or for oils for civilian or industrial use, as sales demands may require.

Correction to Refinery Notebook No. 12

HEATING COILS FOR TANKS

On page 104 of the Refiner's Notebook No. 12 dated October 7, 1944, the tabulation (above Fig. 2) on steam required should read:

Time of heating—	Lb. steam per hour per 1,000 bbl. per degree diff. in temp. of heated oil and air
1 hour	137-141
5 hours	28-32
10 hours	14-18
Long* (50° diff.)	5-8
Long* (100° diff.)	5-10
Long* (150° diff.)	6-12

*Also applies to tank already hot.

Also the last paragraph, just above Fig. 3, should read:

The steam (exhaust) required for heating will be about 14 lb. per 1,000 bbl. per degree difference in air and oil temperature. Heated oil temperature is 130° F. and the air is at 10° F. During heating the steam consumption is about 120 times 14 times 2,500/1,000, or 4,200 lb. per hour. Less than half as much steam is required to maintain the tank at the high temperature.

Cut out the corrected versions and paste them on your copy.

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Corrosion Protection of Tanks

IN one modern large refinery the following large amount of storage is required:

	No. of tanks	Size (bbl.)	Total capacity	Bbl. per bbl. plant capacity
Crude	11	80,000	880,000	...
Crude	7	55,000	385,000	...
Total crude	18	.....	1,265,000	17
Catalytic G.O.	6	80,000	480 000	6
Process	10	25,000	250 000	...
Process	38	10,000	380 000	...
Process	10	.....	50,000	...
Total process	58	.....	680,000	9
Finished tanker	15	100,000	1,500.000	...
Finished tanker	5	80,000	400.000	...
Finished tanker	8	55,000	440,000	...
Total finished tanker	28	.....	2,340,000	31
Pressure, 10 lb.	2	25,000	50,000	...
Pressure, 25 lb.	2	10,000	20.000	...
Pressure, 25 lb.	2	2,500	5,000	...
Pressure, 75 lb.	5	10,000	50.000	...
Pressure, 75 lb.	3	5,000	15,000	...
Pressure, 75 lb.	2	2,500	5,000	...
Total pressure	16	.....	145,000	2
Grand total	126	.....	4,910,000	65

The protection of such an investment from corrosion and from fire is vital. Fire-protection measures are so thoroughly interlocked with insurance regulations that they need not be considered here.

The main areas of internal corrosion as shown in Fig. 1 are: (1) Vapor space, (2) water ring and bottom, and (3) outside ring near soil. Corrosion-resistant metals, with the possible exception of aluminum for roofs, are too expensive and are not used.

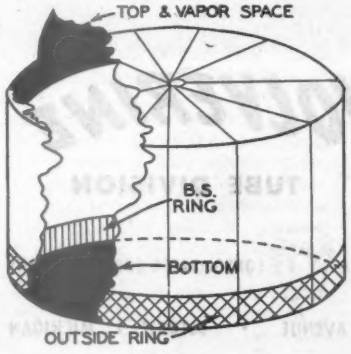

Fig. 1

1. Vapor space and underside of deck corrodes by the action of hydrogen sulfide in the presence of oxygen and by condensation of moisture during the night. Vapor space can be eliminated to a large extent by the use of flexible (breather) roofs for standing tanks and by floating roofs for working tanks. Some refiners wash the roof and upper walls of crude-oil storage at regular intervals by spraying them with the contents of the tank but the spray system is somewhat expensive. A simple method is to wash the rafters and part of the roof at about 2-week intervals by raising the level of the oil. Aluminum and wood roofs are useful, and the use of corrosion-resistant plastic-type paints is said to be successful. Galvanized roofs are expensive but in sour-oil service will usually last twice as long as steel.

2. Bottom and bottom ring corrosion caused by the brine and water that accumulate in crude storage tanks, or by process steam and the breathing of process tanks is the most serious tank corrosion. It is aggravated by "droppings" of sulfide scale from the roof which cause deep corrosion pits in the tank bottom. The bottom can be protected by the use of a concrete bottom and a concrete retainer around the wall to a height above the water level. The concrete bottom may be installed by cleaning thoroughly, laying 1-in. by 6-in. lumber around the wall so that its removal at a later stage will leave a space for sealing compound (e.g. coal tar), pouring 1:2:4 waterproof concrete to a depth of about 4 in., building a circular form for pouring concrete around the wall (again using 1-in. lumber near the wall to provide space for sealing compound), pouring the wall concrete, removing the lumber at the wall for packing with coal tar, and covering the entire sides and bottom with a 1-in. topping of 1:3 waterproof cement mortar. Some refiners have found that a ⅜-in. application of plastic tank-bottom cement is satisfactory. Spent caustic has been used in refinery tanks that contain b.s. and w. that is rich in hydrogen sulfide.

3. Outside bottom ring corrosion is caused by vegetation and the splashing of dirt during rain. Use road oil to kill vegetation around the tank and keep tall weeds down. Keep the tank painted, particularly close to the ground.

The use of gunite on the structural members, roof, shell and bottom, is justified for tanks that are in sour-oil service. The cost ranges from 40 cents per square foot for the roof and structural steel, to about 35 cents for the bottom.

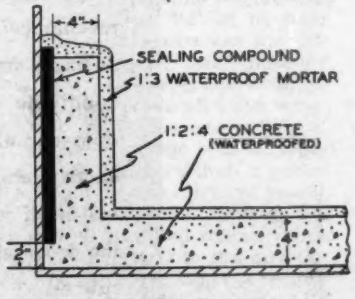

Fig. 2

No. 16 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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Engineering Fundamentals No. 158

A FEATURE OF THE OIL AND GAS JOURNAL

PRACTICAL GEOLOGY OF OIL: MIGRATION OF HYDROCARBONS

HYDROCARBONS in the liquid form will not migrate through a sand until at least one thin layer of the formation, perhaps the layer adjacent to the source bed, contains more than 15 per cent of the hydrocarbons. Also, in order to get the same amount of hydrocarbons to flow at the same rate through the oil sand that contains 30 per cent of water, an increase of more than 50 per cent in pressure differential is necessary. It appears, therefore, that hydrocarbons do not migrate into the oil pool as single, individual, tiny submicroscopic bubbles, as some geologists have suggested, but travel more or less in mass through those thin layers or connected chains of pores where the hydrocarbons have been concentrated. The hydrocarbons probably accumulate in the sand adjacent to the source beds during a long period of time, become somewhat concentrated by the downward movement of the water, and do not migrate up into the oil pools until concentration in the sand is considerable and then only when sufficient pressure differentials have been set up due to diastrophism, folding, and faulting.

It is most likely, as Wallace Pratt has stated, that hydrocarbons migrate in the gaseous state or very light, low viscous, liquid state and then polymerize in the oil pools to form oil rather than move upward in the state of ordinary liquid petroleum, because the viscosity of the gas and hence the resistance to movement of gas by small capillaries is much less than to liquids.

The processes then which cause oil to accumulate in pools are somewhat like those which bring it to a well once the pool is pierced with a drilling bit. Some time ago Wilde, Lahee, and others placed layers of oil-saturated sand and layers of oil-saturated water in a closed tank under a slight pressure.

Over 35,000 samples have been collected from 15 oil-producing states and analyzed by Trask, Painode, and others under American Petroleum Institute Project 4, in studying organic constituents of sedimentary rocks and source beds of petroleum. Studies are continuing on the long-standing and still-open question of distance of migration from source bed to accumulation point.

They lowered the pressure at certain points by introducing tubes resembling miniature wells and watched the oil and water migrate through the sand to the "wells" and flow out to the surface. If the "wells" are closed in, the fluids continue to move until static conditions are reached. In nature much gas and sometimes oil flow out through open cracks and faults in structures and escape to the surface forming seepages and impregnating soils. Flow will continue as long as the dome or structure is rising and pore volume within the structure is increasing and cracks and joints are being opened.

Origin of an Oil Pool

The origin of an oil pool is a complicated process but may be thought of as taking place as follows:

1. Synthesis of hydrocarbons out of source materials some time after fairly deep burial under conditions of moderate heat, and probably after considerable pressure has been applied.

2. Compressing and squeezing of the lighter hydrocarbons out of the source beds through joints and cracks into the porous, water-bearing layers adjacent to the source material by the weight of the overburden.

3. Slow movement downward toward the lower portion of the basin by gravity flow along with and as a part of the slow water movement. Subsurface disposal of some of the water by subsurface evaporation and chemical reactions and eventual concentration of the hydrocarbons in the lower portion of geosynclines, mostly in the layers adjacent to source beds and in most places in the upper layers of the water sands.

4. Formation in the sand sheet of spots of lower pressure on top of the salt plug, above a buried ridge, or along a gravity fault, or at the leaking upper end of a pinched-out sand sheet.

5. Upward movement of the hydrocarbons toward the spots of low pressure during epochs of deformation until static conditions are again established. Water in the sand would move toward the low-pressure area also, but hydrocarbons, especially those in the gaseous state having less viscosity, would move faster and would continue to migrate after water flow had ceased, especially through the larger and more open channels or layers in which gas and traces of liquid hydrocarbons have become concentrated.

6. Polymerization of some of the unsaturated gas molecules to form liquids, and solution of other molecules in the liquids to produce crude oil. Polymerization of gases reduces volume, increases the differential pressure, and therefore tends to perpetuate migration as long as any unsaturated gas molecules remain in the reservoir.

The whole process is slow, probably requiring more than a period of geologic time (millions of years), but none the less the end result is definite—a continual concentration of hydrocarbons, both gas and liquid, until a sizable oil pool results.

Series prepared by F. B. Plummer, professor, petroleum engineering school, University of Texas

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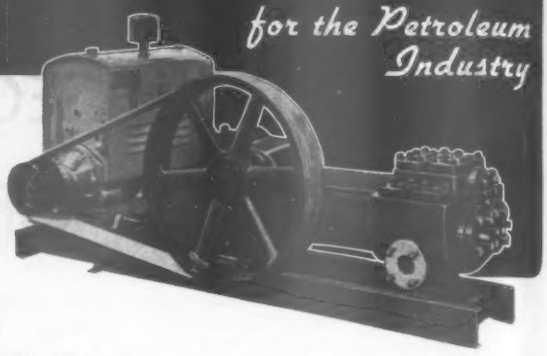

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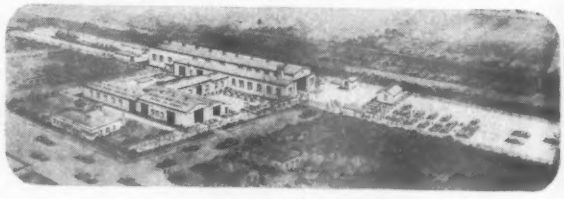

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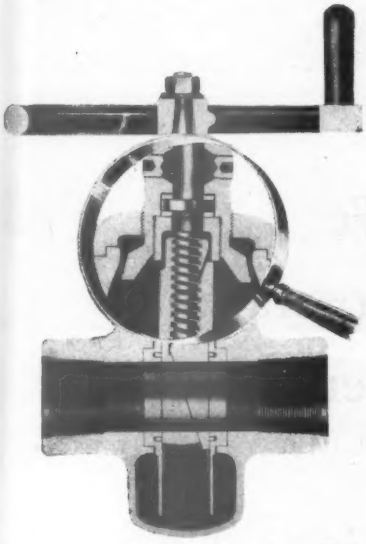
W-K-M Gate Valve

AN outstanding principle of valve-bonnet construction is incorporated in the new steel W-K-M gate valve for general service which has just been announced. In addition to the improved bonnet design, and the body and bonnet of steel rather than iron or semisteel, this valve has all the features which have contributed to the previous success of W-K-M high-pressure valves.

This new model of W-K-M valve is made in both 1,600-lb. test pressure and 1,000-lb. pressure. Literature is available from the W-K-M Co., Inc., Houston, Tex.

The new W-K-M design is a radical departure from the conventional



bolted-on bonnet, and requires no flanges, no bolts and no gland. A perfect seal is effected inside the body, by means of a double tapered ring between similar tapers on the upper inside of the body and the lower outer diameter of the bonnet. In assembly the lower end of the bonnet is inserted in the body, the sealing ring pushed down around the bonnet. Then when pressure is applied, the ring is wedged in place, forming a positive seal. However no residual load is required to maintain a seal. A threaded protector ring or bridge member, is then screwed on the upper end of the bonnet to complete the assembly. Before the application of this ring, the joint may be inspected under the full test pressure. Thus internal pressure, which tends to push off the conventional bolted bonnet, acts to make this seal more positive. The area of the sealing ring is predetermined and requires no permanent deformation to form a seal. The greater the pressure, the tighter the seal becomes, as it is entirely self-adjusting to pressure and temperature changes.

The bonnet and ring are self-aligning, and much less area is exposed to pressure than in the conventional bonnet. Because of the elimination of bolted flanges, this valve has fewer parts, considerably less weight and at the same time provides a greater factor of safety.

"Liqui-jectors" Remove Condensate

A revolutionary principle for automatically and continuously removing condensate from compressed air and gas lines in the oil and gas industries is announced by Selas Corp. of America, Philadelphia—and is embodied in a new family of "Liqui-jectors," adaptable to air and gas lines up to 1¼ in. pipe size and normal line pressures. No moving parts are involved, and no cocks, traps or shutoffs are required in the drain line which is open to the atmosphere. Action is entirely automatic and continuous through two porous ceramic tubes—one inherently water-repellent, the other water permeable but impervious to air.

The product already has been used in connection with pneumatic tools, atmosphere gas generators, compressors, air-actuated control systems, vapor-quench lines, spray and blast equipment, and other pneumatic apparatus in which moisture may corrode the equipment or damage the product.

Basis of operation is a recently discovered method for automatically separating liquid and gas phases by virtue of the surface tension of the liquid. Compressed air entering the "Liqui-jector" passes through the first (and water-repellent) tube where it is stripped of moisture. The action is by coalescence of droplets on the surface of this tube —a coarse ceramic material with an average of 50,000 pore openings per square inch, each so small that the pressure drop across the tube is insufficient to permit water passage against the resisting diaphragm action of its surface tension. The coalesced moisture drops to the bottom of the unit where it passes through the second tube (without loss of air) to outside atmosphere. This second tube is constructed of micro-porous porcelain, with an average of 720 million pore openings per square inch, and (being constantly wet by its wick action) con-

stitutes a perfect air seal up to the rated limit working pressure of the unit. This rated pressure may be manipulated to user specification.

The first-perfected and smallest unit, Model A-150-1, shown in the accompanying illustration, accommodates lines up to ⅜ in. pipe size with line pressures up to 100 p.s.i. Other units are now being perfected to handle the greater demands of the larger lines.

The physical design, as well as the versatility, of this unit is an important feature, for its oval shape permits flush-against - the - wall installation—directly in line—without addition of elbows or other fixtures.

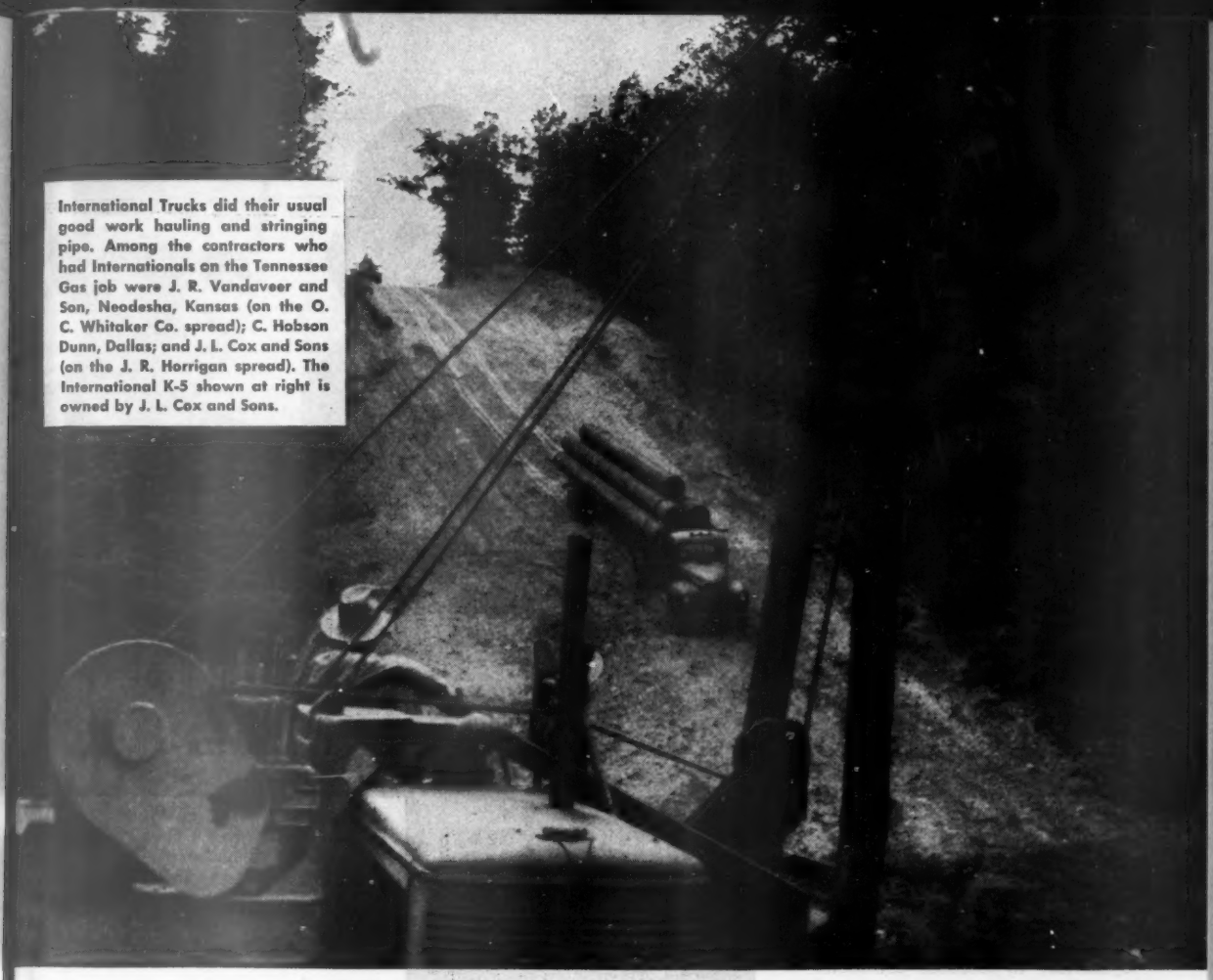
A unique inflection of this separation principle has resulted in the development of larger units, now in pilot-plant operation, for production line liquid-liquid and liquid-gas separations—such as water from oil, and condensed liquid fractions from refinery gas.

SPECIAL SECTION ON TENNESSEE GAS LINE STARTS NEXT PAGE

THANKS

The job is finished. We deeply appreciate the fine cooperation of all who participated in this wartime project.

TENNESSEE
GAS AND TRANSMISSION COMPANY
HOUSTON, TEXAS



International Trucks did their usual good work hauling and stringing pipe. Among the contractors who had Internationals on the Tennessee Gas job were J. R. Vandaveer and Son, Neodesha, Kansas (on the O. C. Whitaker Co. spread); C. Hobson Dunn, Dallas; and J. L. Cox and Sons (on the J. R. Horrigan spread). The International K-5 shown at right is owned by J. L. Cox and Sons.

When it came to welding pipe, International Crawlers were in there pitching. This TD-18 with side boom is owned by Pressure Weld Co., Houston, and is welding on the N. A. Saigh Co. spread.

A veteran International T-40 pulling auxiliary equipment for pressure welding near Soda, Texas. This tractor, owned by J. R. Vandaveer and Son, was photographed on the O. C. Whitaker Co. spread.

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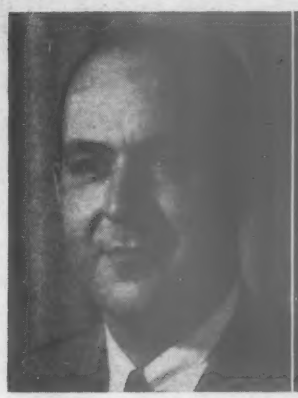


GARDINER SYMONDS

RICHARD WAGNER

RAY C. FISH

I. P. BRISTOW

Carefully Selected Organization Steers Tennessee Gas Line to Successful Completion

IN entering upon the huge undertaking of building the Tennessee Gas & Transmission Co. 1,265-mile system, successfully completed within a period of 9 months, the management of The Chicago Corp. selected its vice president, Gardiner Symonds, to become president of the Tennessee company, with the responsibility of directing activities. Symonds has been in charge of The Chicago Corp.'s oil and gas properties in Texas since the inception of its investments in 1938. Richard Wagner, president of The Chicago Corp., became chairman of the board.

In organizing the staff of the Tennessee company, Symonds drafted the services of Ray C. Fish from The Stearns-Roger Manufacturing Co. to become vice president in charge of engineering and construction. By transfer from the oil and gas division of The Chicago Corp., he procured W. E. Mueller as vice president and treasurer; W. C. Norman, assistant to the president; R. G. Rice, assistant secretary; Harold Burrow, purchasing agent; George Mayes, chief warehouseman, and Charles S. Coates, who has functioned as one of the district and division superintendents. Binford Arney and C. C. Small, Jr., were borrowed from the firm of Small, Arney and Small, state counsel, to head the legal right-of-way department, Arney as vice president and Small as manager.

With this group as a nucleus, the newly formed Tennessee company began to operate on October 1, 1943. During the next 2 months, key personnel was selected for all departments as follows: J. P. Bristow, chief engineer, and K. N. Fancher, pipe-line superintendent, both came from the Northern Natural Gas Co.; Hiram Moore, compressor station superintendent, came from the Lone Star Gas Co.; G. H. McKay, assistant, from the Office of War Utilities of the War Production Board; and as division superintendents in charge of inspection, Tod Pazdral, C. W. Smith, George E. Casey, B. J. Davis,

WILLIAM B. POOR

W. C. NORMAN

W. E. MUELLER

BINFORD ARNEY

CARL MYERS

Ed Erwin and W. E. Fahey; E. N Armstrong, N. D. Linger and a number of others from the pipe-line construction and gas industries.

In August 1944, as a step in the transition period between construction of the pipe-line facilities and development of the operating organization, J. P. Bristow was appointed to the important position of manager of transmission. W. B. Poor, who succeeded him as chief engineer, came from the United Gas Pipe Line Co. Carl Myers, controller, was formerly treasurer of the Ohio Electric Light & Power Co.; C. C. Hale, head of the treasury department, came from Arthur Anderson & Co.

Engineering Consultants

Brokaw, Dixon & McKee, engineering consultants; Matthews & Kenan, design of aerial suspension bridges in Texas and Louisiana; Parkhill-Wade (Henry N. Wade), consultant to The Stearns-Roger Manufacturing Co. in the design of compressor stations and dehydration plant, and Starr Thayer, consultant on pipe coating and cathodic protection.

Engineering Services

Huey & Cage, survey and mapping of Louisiana, Arkansas, Mississippi, Tennessee and Kentucky; Moody Engineering Co., inspection of pipe at the mills; Southern Mapping Co., survey and mapping of Texas and West Virginia, and Tobin Aerial Survey Co., aerial mosaic mapping of Texas and Louisiana.

MAIN LINE SPREADS

Contractor and beginning point:	Total surveyed miles
Sec. 1 (Texas):	
Williams Brothers Corp., Corpus Christi	116.7
Sec. 2 (Texas):	
N. A. Saigh Co., Brazos River	56.3
N. A. Saigh Co., Brazos River	62.7
Sec. 3 (Texas):	
Brown & Root, Inc., Splendora	
Brown & Root, Inc., Sabine River	124.2
Sec. 4 (Louisiana):	
Ray L. Smith Construction Co., Sabine River	62.1
Midwestern Engineers, Bayou D'Arbonne	60.0
Midwestern Engineers, Bayou D'Arbonne River to Ouachita River	3.9
Williams Brothers Corp., Ouachita River	43.3
Sec. 5 (Arkansas):	
Williams Brothers Corp., La.-Ark. state line	31.4
Sec. 6 (Mississippi):	
Williams Brothers Corp., Mississippi River	
Williams Brothers Corp., (Skips)	98.2
Sec. 7 (Mississippi):	
Bechtel-Dempsey-Price, Batesville	75.9
Sec. 8 (Tennessee):	
Williams Brothers Corp., Miss.-Tenn. state line	35.1
Williams Brothers Corp., Tennessee River	1.7
Swinerton & Walberg, Tennessee River	29.9
Williams Brothers Corp., Tennessee River	20.5
J. R. Horrigan Construction Co., Buffalo River	31.6
Williams Brothers Corp., Tenn.-Ky. state line	63.9
Sec. 9 (Kentucky):	
Bechtel-Dempsey-Price, Tenn.-Ky. state line	
Bechtel-Dempsey-Price, Kentucky River	164.9
Bechtel-Dempsey-Price, Kentucky River	
Bechtel-Dempsey-Price, Lawrence-Boyd county line	84.1
J. R. Horrigan Construction Co., Big Sandy River	14.0
Sec. 10 (West Virginia):	
J. R. Horrigan Construction Co., Big Sandy River	
J. R. Horrigan Construction Co., Kanawha River	47.5
Sec. 11 (West Virginia):	
Pipeline Construction Corp., Cornwell station	37.9
Total	1,265.8

Contractors on the Project

Austin Bridge Co., aerial crossings; Coastal Water Well Co., and Elmer R. Lapsley, water wells; Henry Lemons & Co., feeder lines; Midwestern Engineers, Williams Brothers Corp., and Pipe Line Construction Corp., submerged crossings; Pittsburgh-Des Moines Steel Co., aerial bridges and Mississippi River bridge pipe installation; W. J. Riley, residences at compressor stations; Linwood Smith, levee work at Mississippi River; The Stearns-Roger Manufacturing Co., all compressor stations, warehouses, dehydration plant, measuring and regulation stations, check meter stations and sales station; Swinerton-Walberg Co., submerged crossings and tie-in to Memphis Natural Gas Co.

Principal Subcontractors

J. B. Barbour Trucking Co., J. L. Cox & Co., C. Hobson Dunn Co., Parkhill Truck Co., and J. R. Vandaveer, all for stringing of pipe; The Pressure Weld Co., welding of pipe, and C. S. Seal, clearing of right-of-way.

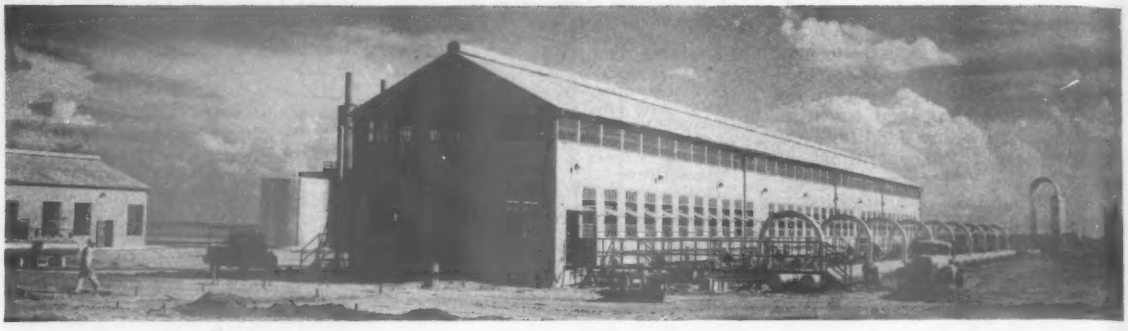
Seven Compressor Stations Spaced According to Best Pipe-Line Economics

by Harold F. Dawe and Henry N. Wade

THE construction program of the Tennessee Gas & Transmission Co. 24-in. pipe line included seven compressor stations and a dehydration plant. In the seven stations, six will recompress the gas through approximately the same ratio at 1.86, while the last station will compress the gas to two different pressures at approximately 900 lb. and 475 lb. for split deliveries into the receiving systems. The gas will move into the dehydration plant under its own pressure to the suction side of the first compressor station located about 160 miles down the line. The average spacing between stations is about 169 miles, with the spacing slightly increasing with increasing distances from the source. The stations were spaced according to calculations based upon the best pipe-line economics and are spaced in an over-all pipe-line length of 1,179 miles.

At present, the gas enters three purchase gas metering stations under natural well pressure after it has passed through several high-pressure absorption plants for extracting the gasoline. The gas enters into the three purchase gas metering stations which are located at the Wardner and Coastal recycling plants of the Chicago Corp., and at the Gulf Plains plant of the Gulf Plains Corp. The Wardner and Gulf Plains metering stations each has a maximum capacity of approximately 150,000,000 cu. ft. per 24 hours, while the Coastal metering station may operate at an approximate maximum capacity of 75,000,000 cu. ft. per 24 hours. The present demand on these three purchase gas metering stations will be approximately 225,000,000 cu. ft. From the purchasing stations, the gas enters into a pipe system where it is transferred to the dehydration plant. From the dehydration plant the gas flows directly into the 24-in. pipe line and flows under its own pressure to the first of the compressor stations.

The present design of the line calls for delivery of 207,000,000 cu. ft. per 24 hours of natural gas to the last station. From the last station 150-165,000,000 cu. ft. per 24 hours will be delivered through a 20-in.



Auxiliary building, compressor building and scrubbers at East Bernard station, Tex.

pipe line to the Hope Natural Gas Co., Cornwell Station, and 35-45,000,000 cu. ft. per 24 hours will be sent through a 12-in. pipe line to the United Fuel Gas Co., near Clendenin, W. Va.

The ultimate design contemplates that 293,500,000 cu. ft. per 24 hours will enter the pipe line at the dehydration plant and the last station will receive approximately 262,000,000 cu. ft. per 24 hours. The difference between delivered fuel and entered fuel is due to fuel consumed in operating the pipe line.

The seven stations, at present, are numbered evenly, 2-4-6-8, etc. This has been done in order that the ultimate design, which calls for interposing additional stations ahead of, and between, the present stations will result in consecutive numbering, 1-2-3-4-5, etc.

The purchase gas metering stations, the dehydration plant, and the seven compressor stations were designed and constructed by The Stearns-Roger Manufacturing Co., and Parkhill & Wade were general consultants. In general, the design of the transmission line and compressor stations has followed lines intended to result in the utmost savings in material and labor consistent with safe and economical operation.

Station Equipment Varied

The seven compressor stations are not all alike in either horsepower or equipment, and as the flows of gas, cooling water, etc., are traced through the station, the equipment in various stations will be mentioned.

Piping design.—The engineers responsible for the design of the compressor plant piping have felt that the cross-country pipe line standards are inadequate for safe application to piping in such plants, even though the above section and division of the code permits carrying the cross-country piping standards into the compressor, provided such stations are outside of cities or villages or closely populated areas. Instead of following this section of the code it was decided to follow the much more rigid standards of Section 3 of the same code, using the standard setup in this section for oil and gas piping inside refinery limits. Extensive use of this latter section of the code over the past 5 or 6 years in the design of compressor plants, particularly for unusually high pressures ranging from 2,500 to 4,000 lb., has indicated that the heavier wall thicknesses are necessary in order to withstand the additional stresses imposed by vibration in the piping immediately surrounding the compressors themselves. This standard was accurately followed throughout the high-pressure gas piping from the plant side of the inlet scrubber to the inlet flanges of the gas aftercoolers. A compromise standard roughly half way between the thicknesses called for under Sections 2 and 3 was selected for piping beyond these points for a distance of roughly 150 yd. each side of the compressor stations. It is felt that this additional safety factor in the piping close to the compressor stations is well justified on account of the concentrated risk to equipment and personnel represented by an operating station.

Dust scrubbers.—The inlet gas to the station is piped through 24-in. pipe to a battery of dust scrubbers. Three of these scrubbers are installed in all stations. At ultimate gas flow all stations, except No. 14, will require four. No. 14, on account of the subtraction of fuel gas, requires only three. These scrubbers

THE AUTHORS

H. F. DAWE

H. N. WADE

Harold F. Dawe, in the oil and gas division of Stearns-Roger Manufacturing Co., acted as chief engineer in design and construction of compressor stations and dehydration plant in connection with the Tennessee Gas & Transmission Co. project. He entered the employ of Standard Oil Co. of California in the fall of 1939 and worked as analyst in organization and cost control department until 1941. Nine years earlier, he entered employ of Shell Oil Co., Inc., as a trainee; spent 11 months in training work and entered the maintenance and construction engineering department where he worked until 1937 as maintenance and construction engineer. He resigned to enter University of Michigan graduate school; did graduate work in petroleum engineering until the summer of 1941 when he graduated with degree of M.S. in chemical engineering.

Henry N. Wade, from the beginning of development of large-scale high-pressure cycling and gas-injection projects, has designed a large proportion of the facilities for plants for such operations. In 1937 he designed and put into operation first commercial natural-gas dehydration plants using diethylene glycol. He designed and put in operation in 1933 first commercial natural-gas dehydration plant operating at high pressure on a main gas-transmission line, using solution of calcium chloride. Following 2 years in the engineering school of University of Southern California, Wade transferred to Cornell University, where he graduated with a mechanical engineering degree in 1914.

Auxiliary equipment at the compressor stations and the diethylene glycol dehydration plant, all integral parts of the transmission system, will be described in later articles by these authors.

are 5 ft. in diameter and have a net shell length of 20 ft. Each vessel is designed according to the A.P.I. A.S.M.E. code for pressure of 786 p.s.i.g., at a temperature of 100° F.

Each scrubber is designed to have a capacity of 75,000,000 cu. ft. per 24 hours of gas. There is a 12-in. bypass around these units to permit taking one unit off the line for cleaning.

The scrubber-oil settling tanks and scrubber-oil charging tank are mounted on steel framework. The dirty oil blown from the base of the scrubbers enters directly into either one of two 5 by 5-ft. tanks, where the dirt is allowed to settle from the oil. The oil, after the dirt has settled, is drawn off through a swing-suction line to the scrubber-oil charging tank. A 3-in. line with shutoff valve is provided from the bottom of each tank. This is designed to drain the accumulated dirt and settlings to be placed into suitable containers for disposal, road surfacing, etc.

The vents, hatchways, etc., in these scrubber-oil settling tanks are made completely weatherproof. This was necessary to prevent moisture from entering into the oil, carrying over to contaminate the dehydrated gas.

For filling the charging tank, a 14-g.p.m. herringbone-gear-type pump, with built-in safety valve, is provided. This pump is so manifolded that it takes suction from the lower half of either of the scrubber oil settling tanks and discharges into the filling tank.

The gas leaving each scrubber passes through a vertical section of 12-in. pipe that serves as a meter run. This run is connected to a recording flowmeter. There is no temperature recorder installed at these runs, as they are not check meters, but are installed only to permit evenly dividing the gas load to the scrubbers. An industrial thermometer in each run indicates temperature. These meters, however, may be used to give an approximate check on the amount of gas flowing into the station.

Selection of compressors.—On account of the lower weight per horsepower of the modern high-speed, angle-type, gas-engine-driven compressor units as compared with the slow speed horizontal types, the War Production Board required that the high-speed machines should be used. It is the opinion of the writers that this decision might have been made anyway without the interference of war conditions. Careful comparative estimates have indicated that the slow-speed horizontal-compressor units, which have been used conventionally in the past on pipeline service, cost from $5 to $10 more per horsepower on an installed basis than the high-speed angle-type units. In many cases up to the beginning of the war emergency the slow-speed units have been preferred in spite of this difference in installed cost because operating data indicated lower-maintenance cost. It is believed that this opinion was often based on insufficient experience with the angle-type units, since such units were not used at all in pipe-line service before about 1937. Further experience with the angle-type units has given increasing evidence that the maintenance costs are little, if any, higher than for the slow-speed units, and consequently, there is a tendency to prefer the high-speed units for all types of service. It is felt that this question cannot be finally settled until a good deal more experience with the high-speed units has been accumulated.

Compressors.—At each of Stations 2, 4, and 6 are presently installed nine 1,000-hp.-in-line, angle-type, gas-engine-driven gas compressors. These machines are placed end to end in a 30 by 304-ft. steel frame, corrugated, galvanized-iron-covered building, having a full ridge vent. These buildings have a bridge-type traveling crane operating the full building length. The foundations for the compressors are made deep in order to provide a basement in the building. The compressor mat has been designed purposely to provide a very rigid and stiff base and generous soil-bearing surface.

At each of Stations 8, 10, and 12 are installed eight 1,000-hp. V-angle-type, gas-engine-driven gas compressors. These engines are placed in a single row side by side with crankshafts perpendicular to the axis of the buildings.

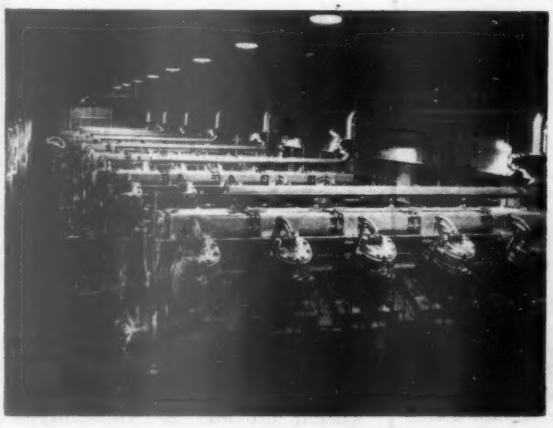
In Station 14 are installed seven of the same units. Full provision is made in Stations 8, 10, 12, and 14 for nine ultimate engines. In station 8 the mat and blocks have been poured and the building sized for nine engines. Station 14 has eight blocks and suitable building.

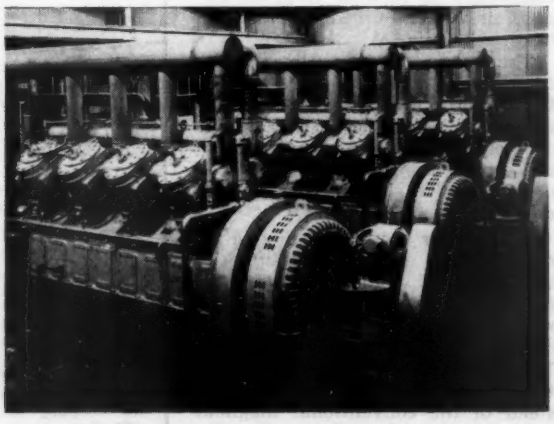
These engines are provided with only one silencer apiece. Air cooled exhaust-jacket arrangements are similar to those in other stations. The same air cleaners and backfire-relief valves are used.

The gas is, at present, compressed from a suction pressure of approximately 401 to 750 lb. through each compressor in Stations 2, 4, 6, 8, 10 and 12. In the ultimate stations, the gas will be compressed from approximately 485 to 750 lb. In this case, the compression ratio will be less and the compression heating will be reduced.

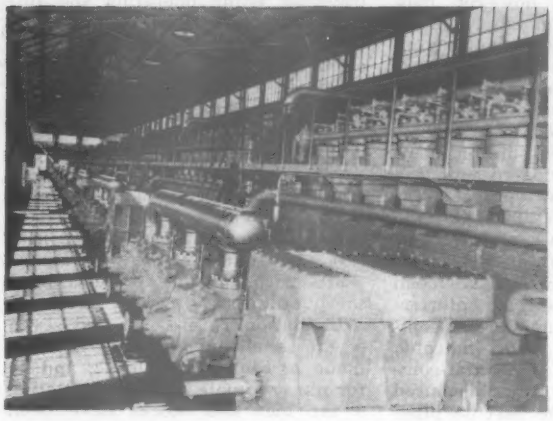
The compressor units in Stations 2, 4, and 6 are provided with three compressor cylinders 8¼ in. in diameter with a stroke of 15 in. The compressor units in Stations 8, 10, and 12 have four cylinders 7½ in. in diameter with 14-in. stroke. All cylinders are provided with built-in clearance pockets to provide necessary clearance for presence and ultimate design.

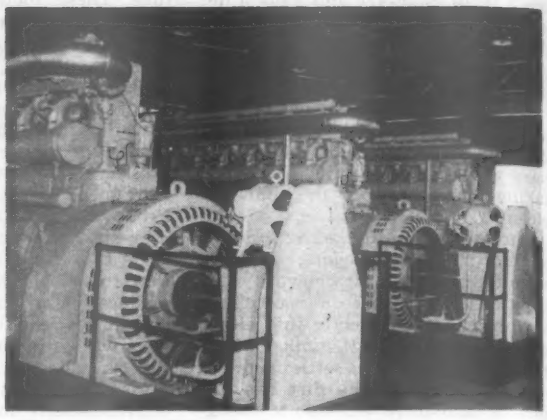
Station 14 has been specially designed for future flexibility. Six of the seven installed engines have one cylinder 8¼ in. in diameter with





Views of 1,000-hp. compressors and 370-hp. gas-engine-driven generator units of types at Stations 8, 10, 12 and 14





Views of 1,000-hp. compressors and 400-hp. gas-engine-driven generator units of types at Stations 2, 4 and 6

14-in. stroke, while the other four cylinders on these units are 7 in. in diameter with 14-in. stroke. The larger cylinders are designed to handle from 35,000,000 to 45,000,000 cu. ft. per 24 hours of gas from an inlet pressure of approximately 400 lb. to a discharge pressure of 475 lb. for delivery to one of the sales outlets. The small cylinders handle from 150,000,000 to 165,000,000 cu. ft. per 24 hours from the same inlet pressure with a discharge pressure up to 760 lb. for delivery to another sales outlet. The two discharge pressures are required in order to fill contractual obligations for fuel gas. The high pressure gas from Station 14 is delivered through a 20-in. pipe line a distance of 82 miles to Hope Natural Gas Co., Cornwell station, and the low-pressure gas is delivered 7 miles through a 12-in. pipe line to the United Fuel Co. at Clendenin, W. Va.

All cylinders in this station are equipped with unloaders, valve lifters, and built-in clearance pockets in order to adequately cover the pressure-range requirements.

The gas is discharged from each compressor through a 10-in. branch line which is saddled from an expansion bend into a 24-in. discharge header.

The buildings housing the engines in Stations 10, 12 and 14 are 36 ft. 202 by 20 ft., and 36 by 228 by 20 ft. in Station 8. In these stations, the compressor foundations are also deep and a full basement is provided. Full basement ventilation is also provided as in Stations 2, 4 and 6.

Compressor ignition. — Engine ignition is the direct-current-impulse type with individual-induction coils for each spark plug. Engines of one manufacture are provided with one distributor handling 10 cylinders. The other engines have dual-ignition systems for eight cylinders. Instead of the conventional magneto source of power to the ignition coils, there is provided an individual direct current rectifier of the copper oxide type for each engine. These units are supplied from a 440-volt, 3-phase, 60-cycle source, having their own built-in transformers, and provide a practically rippleless 10-14 volt, 2 to 4-amp. direct current which will supply the ignition demands of all engines. Each unit has its own volt and ampere meter, built-in circuit breaker, and rheostat for varying the voltage as required. There are no batteries in the ignition circuit.

This system of ignition was developed for the first time for this project and has been thoroughly tested under actual operating conditions by the engine manufacturers. It provides an exceptionally clean and trouble-free direct-current source.

One distinct advantage of this system is that it provides a foolproof interlock between the station electric generators, water-circulating pumps and engines. If the electric power fails for any reason, the water-circulating pumps on the jacket-water system being electric driven, necessarily shut down. Since the compressor ignition system will also shut down upon a power failure, the compressors are stopped at once, making it impossible for them to become overheated by running after failure of jacket-water circulation.

Another advantage is that each machine has its own individual rectifier unit and is, thus, independent of all the other machines. Thus the entire station cannot be shut down through failure of an element of the ignition supply.

There is a drain pan in the compressor floor directly connecting into the dirty-oil tank, and another connecting into the clean or reclaimed-oil tank. In case polluted oil must be disposed of, it may be poured down into the dirty-oil tank, and clean oil may be returned to the reclaimed or clean-oil tank through these drain pans. This lubrication system provides for flexibility in handling lube oil and with a minimum of waste.

CHRONOLOGICAL PROGRESS

1940

April 1.—Tennessee Gas & Transmission Co. was incorporated in Tennessee for the purpose of transmitting gas to certain localities in Tennessee and Alabama.

1943

August 28.—War Production Board formally indicated need of project to deliver additional gas to Appalachian area to serve the war program.

September 7.—Contract between The Chicago Corp. and Tennessee company effective.

September 20.—The Chicago Corp. purchased 90 per cent of stock of the Tennessee company.

September 24. — Federal Power Commission issued Certificates of Public Convenience and Necessity to the Tennessee company to build a line from Southwest Texas to the Appalachian area.

October 1. — Orders for major equipment were placed with manufacturers.

October 2. — Temporary offices were established in Houston.

October 25.—Gas sales contract was executed with Hope Natural Gas Co.

November 5.—Main line and river crossing contractors were selected.

November 23. — First pipe was shipped from the mills.

December 4.—Construction ceremony at river in Tennessee.

1944

January 10.—First main-line pipe welded.

January 29.—Gas sales contract executed with United Fuel Gas Co.

January 31. — First compressor shipped by manufacturer.

March 1. — Gas purchase agreement executed with Gulf States Oil Co.

July 20.—Last compressor shipped by manufacturer.

September 1.—Last pipe shipped from mills.

October 28.—Final tie-in in Tennessee. Total elapsed time since first pipe was welded 260 days.

October 29.—First gas delivered. Total time elapsed since acquisition of company by The Chicago Corp. 373 days.

Engineering Design of System Result of Detailed and Accurate Calculations

ENGINEERING design of Tennessee Gas & Transmission Co.'s natural-gas transmission system from the natural-gas reserves in Nueces County, Texas, to Cornwell station, West Virginia, provides for facilities to gather residue gas from the Wardner, the Coastal and the Gulf Plains cycling plants and to transport it to a dehydration plant, then to the main line for transportation east. Capacity of the system is based upon recommendations by the War Production Board. It is designed under the initial operation to transport 207,000,000 cu. ft. of gas per day into No. 14 compressor station at a pressure base of 14.73 p.s.i. and under the ultimate operation to deliver 262,000,000 cu. ft. of gas per day. The maximum operating pressure is 750 p.s.i.g.

Main features of the design of the system are 1,180 miles of 24-in. pipe; 85 miles of 20-in. pipe; 7 compressor stations containing 58,000 installed compressor horsepower under the initial design and 14 stations containing 118,000 installed compressor horsepower under the ultimate design; a dehydration plant with a capacity ranging from 225,000,000 to 300,000,000 cu ft.; employe housing where required, and all other facilities for making system a complete operating unit.

Summary of Specifications

The design of all the component parts is the result of detailed engineering calculations, embracing determination of pipe size, wall thickness, working pressure, number and location of compressor stations and all other phases of the project.

Following is a summary of specifications of the system:

Length—Miles

Main line—24-in. pipe	1,180
Main line—20-in. pipe	85

Pressures

	P.s.i.g.
Max. operating pressure—24 in.	750
Terminus pressure	475
Compressor station suction pressure	400
Comp. station discharge pressure	750

Capacity

	Cu. ft.
Initial design	207,000,000
Ultimate design	262,000,000

Cubic Foot

Absolute pressure (p.s.i.)	14.73
Temp. (°F. or °Absolute)	60-520
Gravity	.60

Pipe Line

(Welded construction throughout)

Outside diam. (in.)	24	24	20
Wall thickness (in.)	9/32	1/4	9/32
Miles	300	880	85
Min. yield point (lb.)	45,000	50,000	45,000
Min. tensile strength (lb.)	70,000	70,000	70,000
Bursting pressure (lb.)	1,641	1,458	1,968
Yield pressure (lb.)	1,055	1,042	1,265
Safety factor on yield point	1.4	1.39	1.67
Safety factor on tensile strength	2.19	1.95	2.62
Pipe weight per mile of line—(tons)	188.1	167.41	156.37

Coatings

	24 in.
Miles	1,079
Coats of primer	1
Coats of enamel	1
Felt wrapper	1

Compressor Stations

	Initial	Ultimate
Number of stations	7	14
Spacing (approx. miles)	170	85
Total number of units	58	118
Total installed horsepower	58,000	118,000
Compressor ratio (average)	1.83	1.54
System fuel consumption per day (12 cu. ft. per horsepower-hour operated) peak load conditions, 1,000 cu. ft.	16,704	33,984

Gas Measuring Stations

Purchase gas stations	3
Check meter stations	3
Sales meter stations	3

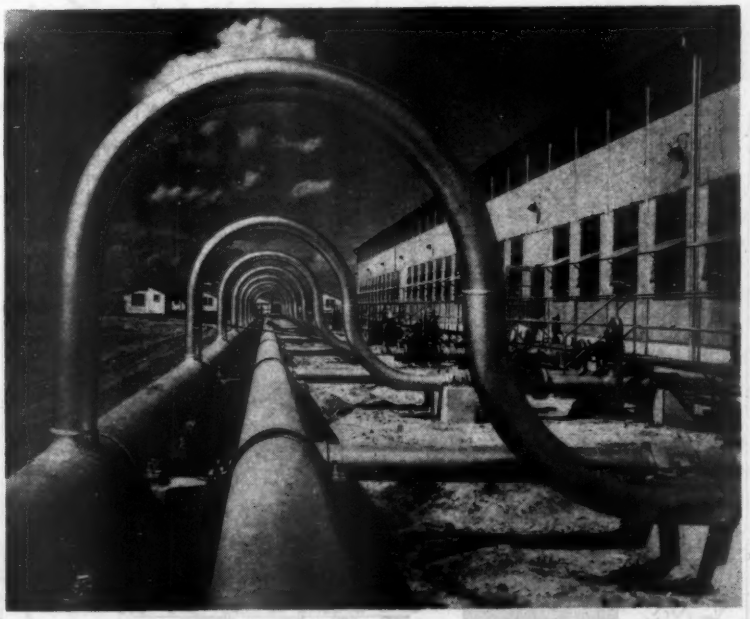
Main Line Valves

(Type: Lubricated plug vales, with welding ends)

	24 in.	20 in.
Average spacing	10	10
Total to be installed	141	8

Route

Route of the pipe-line system begins at a point near Pintas Creek, Nueces County, Texas, and extends to Hope Natural Gas Co.'s Cornwell station, approximately 5 miles east of Clendenin, W. Va. Beginning at Pintas Creek, the line traverses the southern part of Texas in a northeasterly direction just north of Houston; the State of Louisiana south of Shreveport and north of Monroe and crosses the Mississippi River at Greenville, Miss. From the Mississippi River the line continues in a northeasterly direction traversing Mississippi slightly north of Batesville, the State of Tennessee north of Nashville, to a point near Danville, Ky. At Danville the route takes a turn more to the east to a point 14 miles below Catlettsburg, W. Va. At this point the size of the line changes from 24-in. pipe to 20-in. pipe and traverses West Virginia in a northeasterly direction to Cornwell station. The total length



Station piping with sickle bends at East Bernard, Tex., compressor station. All gas line piping at stations is above ground

of the line is 1,265 miles, consisting of 1,180 miles of 24-in. pipe and 85 miles of 20-in. pipe.

Operating Pressure

The 24-in. pipe will operate under a maximum pressure of 750 p.s.i.g.; and the 20-in. pipe under a maximum pressure of 912 p.s.i.g. Operating at these pressures the safety factor of the pipe will be 1.4 on the yield point and 1.95 on the bursting strength.

The American Standards Association's Code for Pressure Piping (Gas and Air Piping), Division 2, states that pipe may be operated up to 80 per cent of the mill test. The Tennessee has required that all pipe be tested to 90 per cent of the yield point. Therefore, with the above specifications the pipe line was designed to operate at a maximum pressure of 72 per cent of the yield point of the steel.

The WPB in an effort to reduce the steel tonnage required the pipe line to be constructed of a steel containing a high manganese content and a high yield point. However, due to the availability of manufacturing facilities they required that 300 miles of the 24-in. pipe and all of the 20-in. pipe be made in a mill in which the highest yield point available was 45,000 lb. and 900 miles of the 24-in. pipe made in a mill in which the yield point available was 50,000 lb.

Barlow's formula, which is as follows, was used in calculating the wall thickness required for the two sizes of pipe:

$$P = \frac{2ft}{D}$$

D = outside diameter of pipe
t = nominal thickness of wall (in.)
P = internal pressure in p.s.i.
f = fiber stress in p.s.i.

Fiber stress can equal the yield point or the tensile strength of the steel.

The wall thickness required in the 24-in. pipe made of steel with a yield point of 50,000 lb. is ¼-in. and that made of a steel with 45,000 lb. is 9/32-in., and the 20-in. pipe made of steel with a yield point of 45,000 is 9/32 in.

That section of the main line using 20-in. pipe is designed for 912 p.s.i. maximum operating pressure so that in case of an emergency and in the anticipation of the ultimate design the full load of the line can be carried in this section. The terrain traversed by the 20-in. section is mountainous and the thicker wall pipe lends itself better to field bending and the type of construction which is necessary in this country.

Capacity

Capacity of the 20-in. section of the main line from No. 14 compressor station to Cornwell station, West Virginia, operating under the initial design of 750 p.s.i. at No. 14 station and 475 p.s.i. at Cornwell will be from 155,000,000 to 165,000,000 cu. ft. per day at a pressure base of 14.73. Under the ultimate design with 912 p.s.i. at No. 14 station and 475 p.s.i. at Cornwell, the capacity will be 237,000,000 cu. ft. per day.

Before designing the pipe-line system all the major gas-transportation companies were contacted in order to find the most adaptable flow formula. It was found that the Panhandle formula more accurately indicates the actual flow of gas in pipe lines. The Panhandle formula is an improvement of the Weymouth formula based on experience the Panhandle Eastern Gas Co. has had on their transmission system.

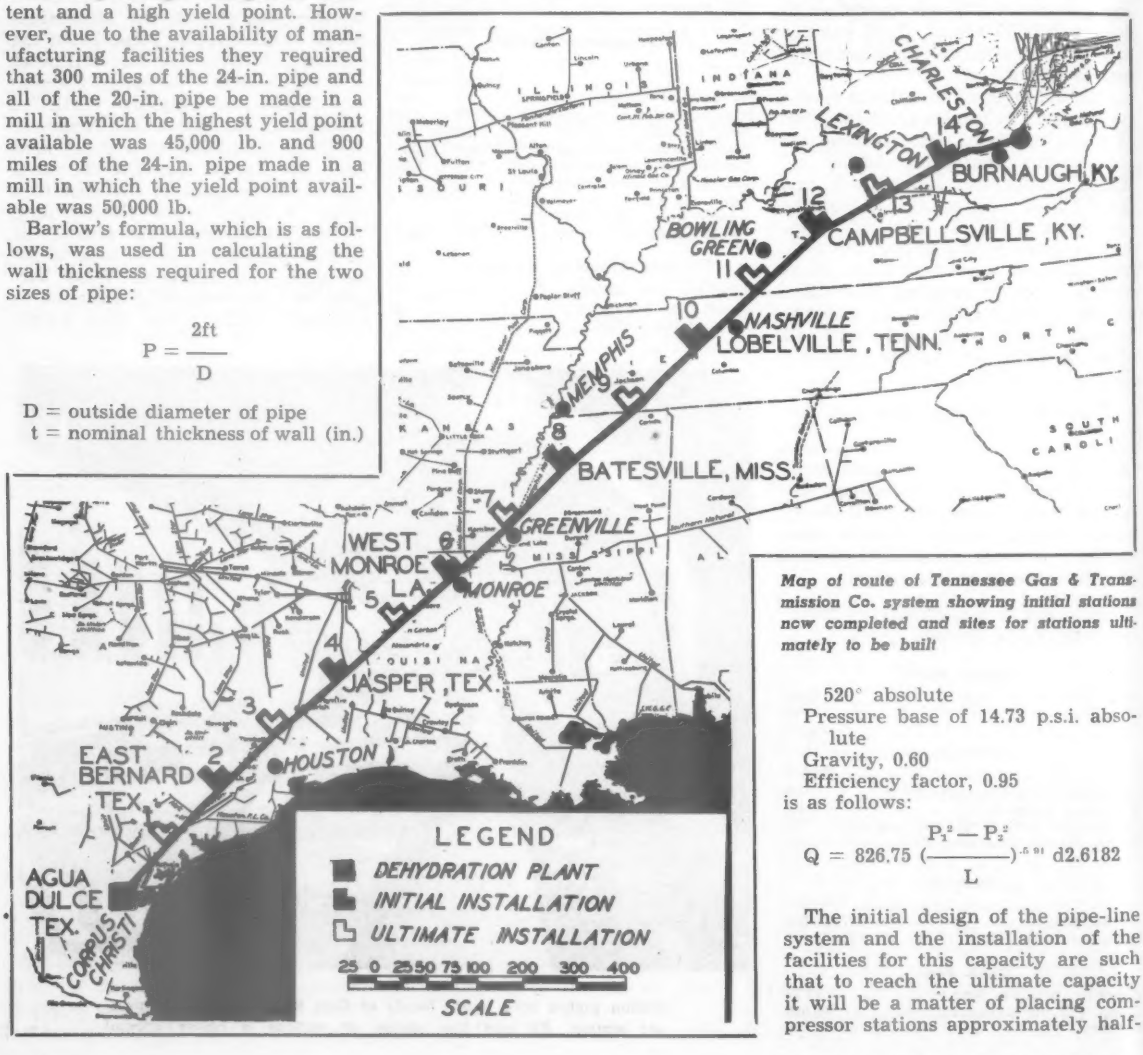
The formula, adjusted for flow conditions that will be encountered in operating the Tennessee Gas & Transmission line, namely,

Flowing temperature 75° F., or 535° absolute
Temperature base of 60° F., or 520° absolute
Pressure base of 14.73 p.s.i. absolute
Gravity, 0.60
Efficiency factor, 0.95

is as follows:

$$Q = 826.75 \left(\frac{P_1^2 - P_2^2}{L}\right)^{.5\,91} d^{2.6182}$$

The initial design of the pipe-line system and the installation of the facilities for this capacity are such that to reach the ultimate capacity it will be a matter of placing compressor stations approximately half-



Map of route of Tennessee Gas & Transmission Co. system showing initial stations now completed and sites for stations ultimately to be built

way between those installed under the initial design.

Feeder System

The feeder system is designed to operate at a capacity ranging from 225,000,000 to 300,000,000 cu. ft. per day and connects the Wardner, the Gulf Plains and the Coastal cycling plants into the dehydration plant. It consists of 15,500 ft. of 12¾ by 0.340-in. pipe and 25,500 ft. of 18 by ⅜-in. pipe and 6,000 ft. of 10¾ by 5/16-in. pipe.

The system is designed to operate with a 1,000-p.s.i. pressure gage at the Wardner and Gulf Plains cycling plants and 900-p.s.i. pressure gage at the Coastal cycling plant delivering gas into the dehydration plant at 800 p.s.i.g.

Main Line Block Valves

The system has been equipped with main line size worm gear operated Merco Nordstrom welded and lubricated-plug valves installed at an average spacing of 10 miles. This spacing of the valves provides an isolation of any 10-mile section of line for maintenance or repairs.

These valves were selected in order to have an immediate and accurate shutoff under any condition and to have a minimum pressure drop through the valves. These valves, although main-line size, have a restricted area through the plug, but they are designed so that there is a venturi effect of the flow of gas through the valves thereby producing a minimum pressure drop. Welded end valves were specified to eliminate flanges, gaskets, and alloy studs and nuts.

The valves, with watertight 7-ft. gear extension, permit their installation without the use of valve boxes. These valves were assembled and prefabricated and shipped for installation in the main line with a minimum of field welds. The weld between the valve and the main line nipple was X-rayed before shipment. When critical materials and fabricating facilities are available these valves will be equipped with automatic shutoff devices.

Coatings and Wrapping

The line has been coated with one coat of primer and one coat of coal tar enamel and wrapped with asbestos felt from Corpus Christi, Tex., to the Dix River in Kentucky, a distance of 1,045 miles. The soil in this area is classified as very corrosive to medium corrosive. Approximately 34 miles in low areas in Kentucky will be coated and wrapped. These low areas in Kentucky are approximately 24 miles in Clark, Powell, Montgomery and Menifee counties, 7 miles in Carter County and 3 miles in Boyd County.

All pipe in river crossings has been coated with coal tar enamel and two asbestos wrappers applied over the coating and that portion of the pipe immediately under the river weights has been wrapped with four additional layers.

Pulling section of 24-in. pipe across Clear Lake, Louisiana

The remainder of the line has been laid bare because the history of pipe lines in that area indicates that there will be very little trouble from corrosive conditions.

Primer and enamel materials for coating were supplied by Barrett Division of Allied Chemical & Dye Corp. and Wailes-Dove-Hermiston Corp. Pipe-line felt for wrapping coated line was manufactured by Johns-Manville Sales Corp. and Philip Carey Manufacturing Co.

Cathodic protection will be installed on that portion of the line laid in areas where corrosive conditions are known to exist or laid adjacent to pipe lines that now have cathodic protection. The section from Corpus Christi to Memphis, Tenn., is considered to be very corrosive and cathodic protection is now installed on other lines in this area. Therefore, cathodic protection will be placed on this section of the line immediately. Cathodic protection will be postponed on the remainder of the line until such time as survey indicates that corrosive conditions exist.

The three types of measuring stations constructed on the system

(Continued on page 120)

DESIGN DATA CHART—COMPRESSOR STATIONS

Initial Design

Station No.	Horsepower required	No. of units	Installed horsepower	Fuel req., M.c.f./day	Op. cap., M.c.f./day	Mi. sta. to sta.	Pressure abs. Suction	Pressure abs. Discharge*	Comp. ratio
2	8,801	9	9,000	2,592	221,688	162.57	410	760	1.86
4	8,696	9	9,000	2,592	219,096	157.40	416	759	1.86
6	8,592	9	9,000	2,592	216,504	160.10	416	772	1.86
8	8,676	8	8,000	2,304	213,912	173.81	409	772	1.89
10	7,685	8	8,000	2,304	211,608	166.70	438	772	1.76
12	8,234	8	8,000	2,304	209,304	178.63	416	769	1.85
14	7,042	7	7,000	2,016	207,000	180.70	416	761	1.83
Total	57,726	58	58,000	16,704	204,984	1,179.91			

Ultimate Design

1	8,918	9	9,000	2,592	293,680	78.08	496	772	1.56
2	9,249	9	9,000	2,592	291,088	84.49	473	772	1.63
3	8,301	9	9,000	2,592	288,496	80.00	499	772	1.55
4	7,633	9	9,000	2,592	285,902	77.40	515	772	1.50
5	7,563	8	8,000	2,304	283,312	79.22	513	772	1.50
6	7,688	9	9,000	2,592	281,008	80.88	512	772	1.51
7	8,105	8	8,000	2,304	278,416	86.84	494	772	1.56
8	7,934	9	9,000	2,592	276,112	86.97	499	772	1.55
9	7,267	8	8,000	2,304	273,520	83.40	518	772	1.49
10	7,082	8	8,000	2,304	271,216	83.30	523	772	1.48
11	7,818	8	8,000	2,304	268,912	92.33	496	772	1.56
12	6,953	8	8,000	2,304	266,608	86.30	522	772	1.48
13	7,037	8	8,000	2,304	264,304	90.40	513	772	1.50
14	7,905	8	8,000	2,304	262,000	90.30	519	893	1.72
Total	109,454	118	118,000	33,984	259,696	1,179.91			

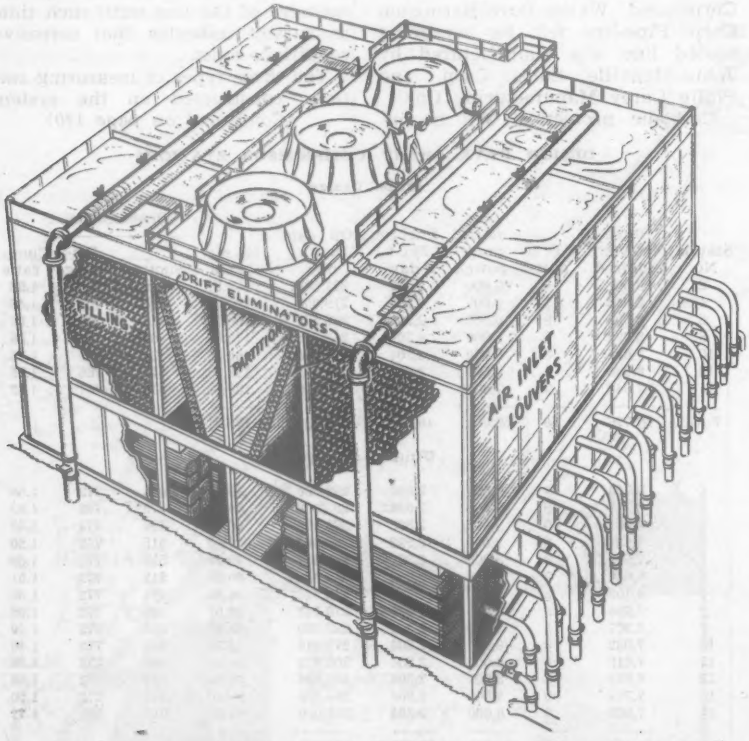
*Discharge pressure increase 7 lb. for pressure drop in station, in calculating horsepower required. Pressure base—14.73 p.s.i.a. Delivery pressure—475 p.s.i.g.

Double-Flow Horizontal Induced-Draft Cooling Towers Installed at Stations

COOLING towers which are installed in duplicate at all seven stations of Tennessee Gas & Transmission Co. are technically described as the double-flow horizontal induced-draft towers of the SpraCoil type. This terminology means that each fan draws air horizontally through two cooling chambers simultaneously. (See accompanying cutaway drawing.) SpraCoil is a designation for any tower having in its base a system of atmospheric heat exchangers over which the raw cooling tower water is showered to absorb heat through the tube walls and thus indirectly cool whatever fluid is circulated inside. In the case of these Tennessee line towers, gas, jacket water, and lube-oil cooling water, in a number of separate circuits, are cooled to different temperatures which are variable at will.

Such towers had proved well adapted to some very complex services, especially in recycling plants, first by permitting all of the several indirect cooling functions to be combined in one cooling tower and, second by providing independent and flexible operation for each function. This experience had demonstrated the value of having a "redistribution system" located at a level beneath the cooling tower proper and above the substructure (called a "coil shed") housing the heat exchangers. By this means the cooled water is collected in an intermediate catch basin from which it can be redistributed with complete uniformity over the heat exchangers below.

The tower as built at all the Tennessee line stations is made up of three fan sections or six cells, three on either side. All parts requiring regular inspection are easily accessible, and since every part and detail of every tower is identical, a safe inventory of replacement items is quite small and there is no need to keep a specific stock at every location.



Cutaway drawing showing the general design and functioning of the Marley double-flow horizontal induced-draft tower, "SpraCoil" type. As in case of the T. G. & T. Co. towers, the one pictured is made up of three fan units

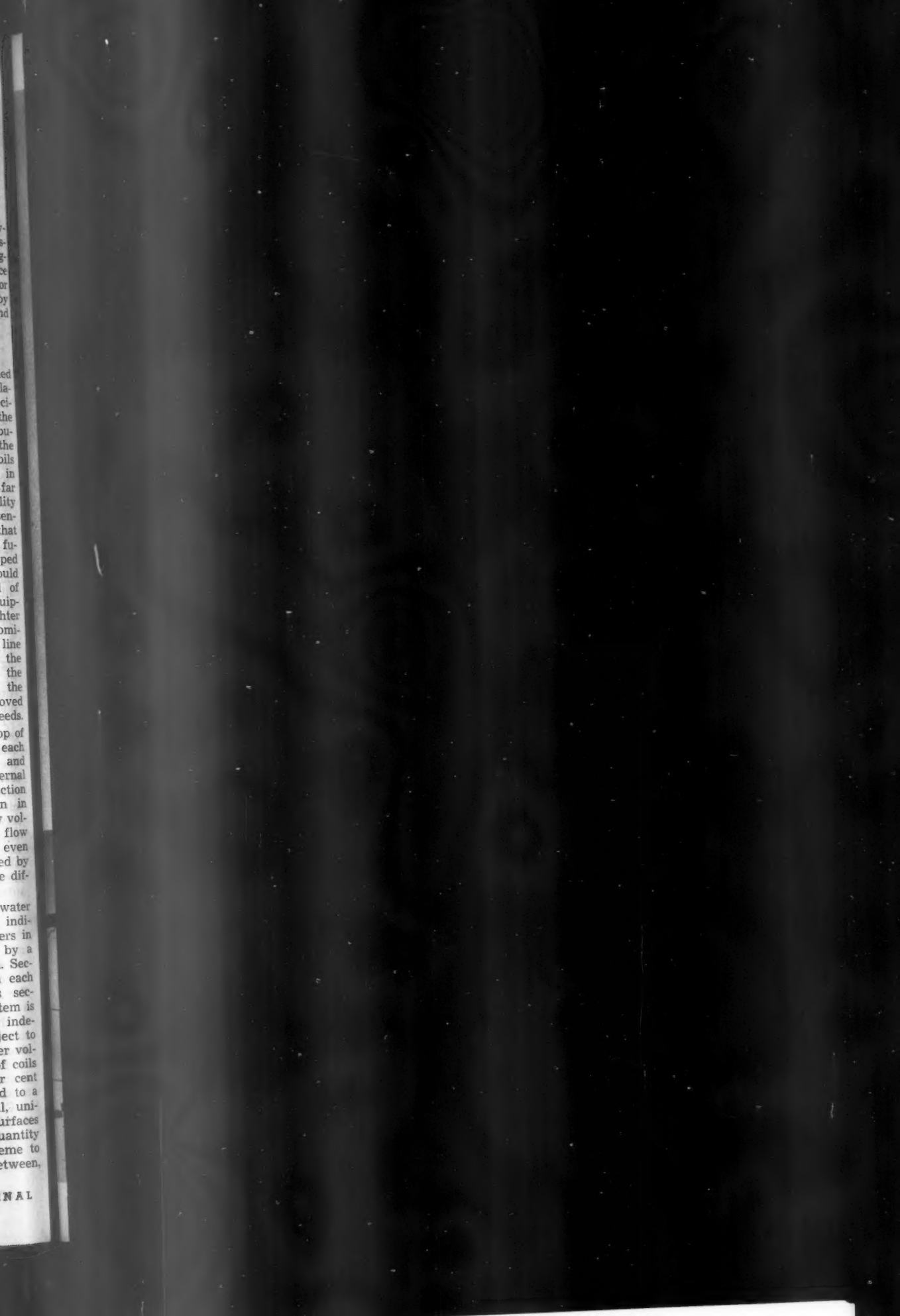
Further, the volume of water showered over any of the separate systems of heat exchangers can be regulated just as cooling performance within the various fan sections or "cells" of the tower is controlled by adjusting the supply of water and flow of air.

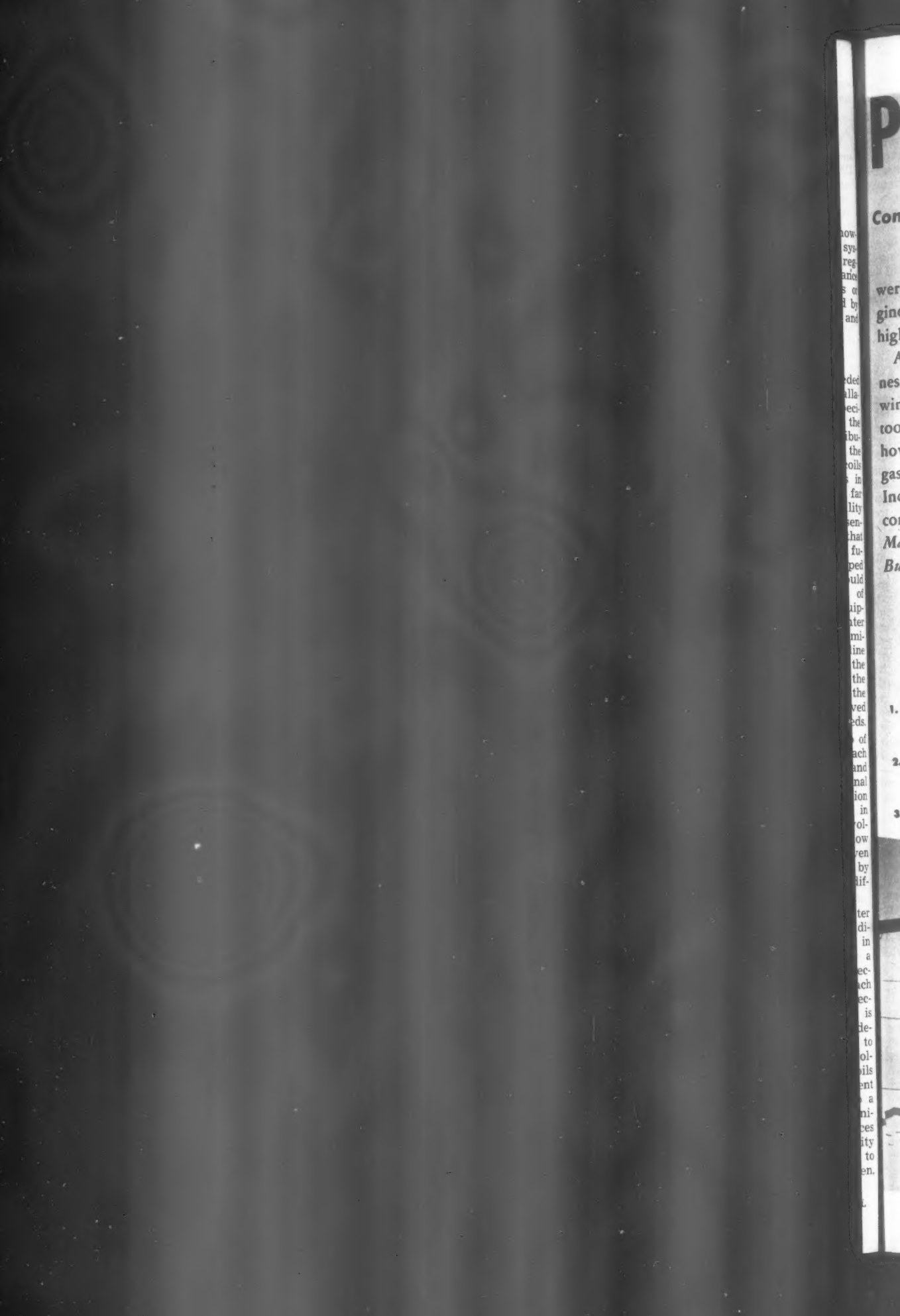
Operating Flexibility

Operating flexibility was needed for the Tennessee company installations. With all seven towers specified for one predetermined rate, the engineers asked that the redistribution system be so designed that the water volume to all stacks of coils not only could be decreased as in earlier towers but also increased far beyond design capacity. This ability to handle heavier loads was essential because of the likelihood that the line would see considerable future expansion, and it was hoped that foresighted engineering could spare the owners a great deal of revamping and enlarging of equipment. The ability to adjust to lighter loading would permit more economical operation at times when the line might not be at full flow. In the matter of operating flexibility, the unique water distribution in the double-flow horizontal tower proved well suited to Tennessee line needs.

The primary system at the top of the tower supplies water to each cooling chamber independently and all parts are completely external with control valves for each section readily accessible. Distribution in any cell is fully effective at any volume from twice the normal flow down to complete shutoff. Thus even the two cooling chambers served by the same fan may handle quite different loads.

Similar variability of the water quantities showered over the individual stacks of heat exchangers in the substructure is provided by a patented redistribution system. Sectionalized to correspond with each group of coil sections, this secondary water-distributing system is actually a series of wholly independent reservoirs, each subject to easy regulation, whereby water volume over any or all stacks of coils can be increased to 100 per cent more than normal or reduced to a mere fraction of normal. Full, uniform coverage of the tube surfaces is maintained regardless of quantity and the shift from one extreme to the other, or any point between,



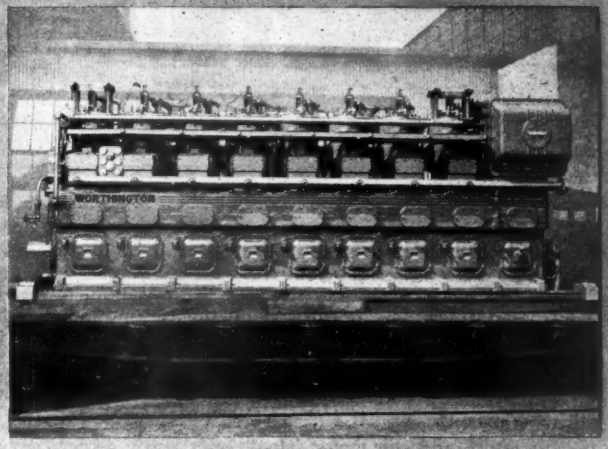


PIPELINE JOB SINCE '32

Compressors, Generating Units and Pumps for Main Line Pumping Stations

were supplied from a single source, engineered together as complete units for highest efficiency.

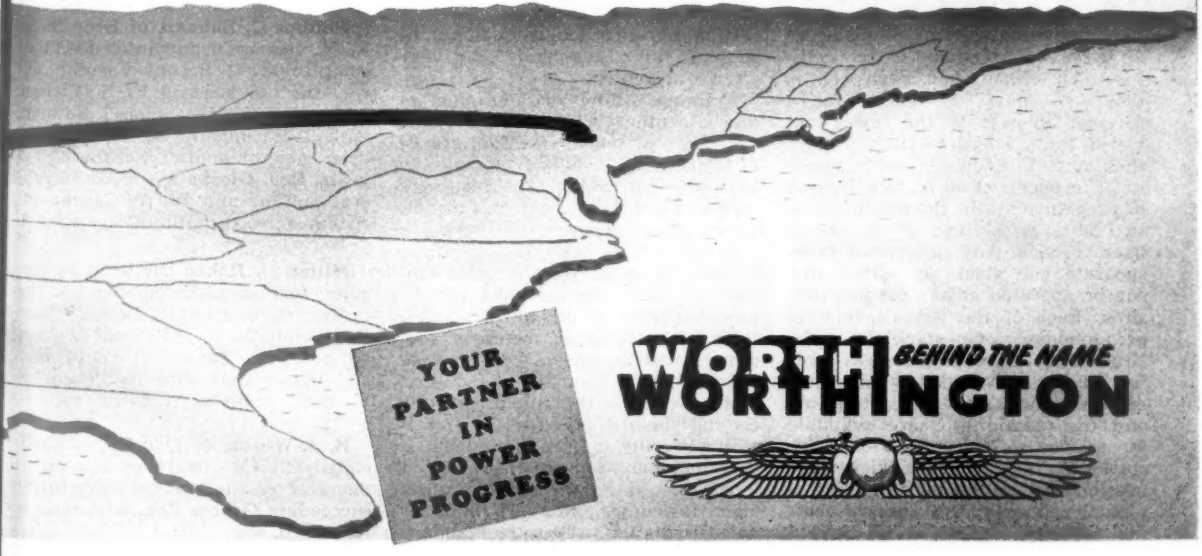
Another construction victory in Tennessee Gas and Transmission Company's win-the-war effort. Another example, too, of Worthington's pipeline "know-how" and broad range of products for gas and oil transmission now at work for Industry and the Nation. Write us for complete details. *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*

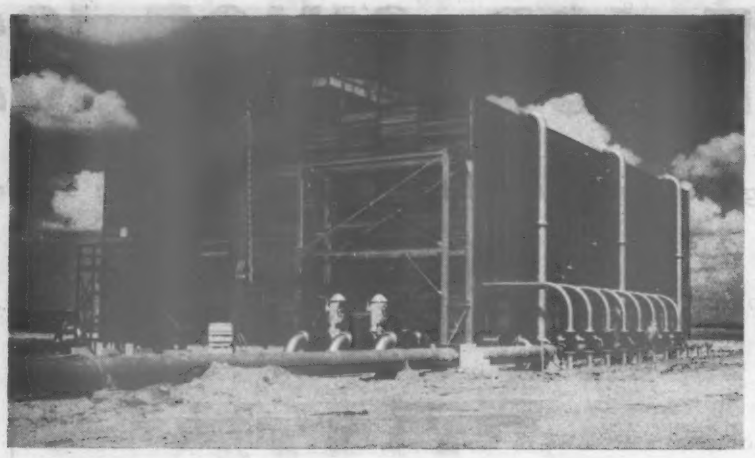


A Worthington 1,000 hp LFC Gas Engine Compressor ready for shipment.

5 Reasons Leading Companies Specify Worthington for Pipeline Units

1. **Heavy Construction**—ample masses of metal in correct structural relation, for strength, rigidity, maintained alignment, low maintenance, long life.
2. **Straight-Line Design**—maximum accessibility for simple, safe inspection and adjustment. Smooth power flow from equally spaced power impulses.
3. **Single Scavenging Air Pump**—easily accessible for maintenance, with simple piping for low-cost installation
4. **Cone-type Cylinder Head**—bolt-loading on cold upper surface, no risk of cracking when tightened, no bending under heat stress, cuts engine repair cost.
5. **Cast-In Lube Oil Ducts**—all lube oil in cast-in passages ends risk of pipe breakage, with no joints or pipes to break or loosen.





East Bernard, Tex., compressor station's cooling tower with water pumps and gas piping

is accomplished quickly and simply.

Both the primary and secondary systems operate by gravity flow.

During cool weather and at times of light load the double flow operates well by any of several alternative methods for conserving fan and pumping power: (1) In sufficiently cold weather the fans may be shut off completely and the water lifted only into the redistribution system, thus effecting a maximum reduction from normal power requirements. (2) If slightly more cooling is required the fans may be left idle but part of the water distributed over the tower through the primary system while the remainder is bypassed to the secondary system. Increased cooling is obtained as more water is put over the tower and less is bypassed. Ample air movement through the cooling chambers occurs by natural convection. (3) For still greater cooling the fans may be turned on, first only one, then two if necessary, and finally all three for maximum performance.

The tower, as built at all of the Tennessee line stations, is made up of three fan sections or six cells, three on either side. Each cell is five 6-ft. "bays" in length, for a total of 30 bays to the tower and a total tower length of slightly more than 90 ft. The tower's width, somewhat in excess of 60 ft., is sufficient to accommodate in the substructure two 30-ft. wide rows of coil stacks back to back. Any number of these separate coil stacks in either row can be operated at any capacity desired. Each of the tower's 30 bays accommodate one stack of coils. Nine of them are used for gas cooling, 12 for soft water which cools engine jackets and lubricating oil, and the remaining 9 are available for service as the line's loads increase. With gradually heavier transmission of gas through the line a virtual certainty; this reserve cooling capacity is sure to be needed shortly and can thus be put into use without requiring the services of the cooling tower manufacturer.

Total pumping head to the primary water distribution system at the top of the tower is only 30 ft., including the 10-ft. height of the substructure which houses the atmospheric heat-exchanger stacks. For easy direct access to the coil sections, the entire walls on both sides of the substructure consist of solid doors on rollers. This convenient feature ties in with another device of exceptional merit, namely a patented air bypass damper whereby the hot saturated air off the coils is drawn upward in regulated volume into the suction chamber of the tower above and thence goes out the fan, along with the exhaust air which has passed through the cooling tower proper.

Advantages of Horizontal Design

Due to its horizontal design, the height of the tower is unusually low for its capacity by comparison with other designs. This not only results in a surprisingly small pumping cost but also makes for a very sturdy structure.

Framing, filling, drift eliminators and all other wood parts of the tower are of select, specified grades of California redwood, completely prefabricated in the manufacturer's plants. Field labor, by this means, was limited to assembly work.

In accordance with the specifications, all fans, drives and other mechanical parts, are identical and interchangeable in all towers. Likewise all structural members and other wood pieces are the same in every tower, even to the filling which occupies the interior of the cooling chambers. A feature of this filling worthy of mention is that it goes together by means of slots and mortises, using no nails or other rigid fastenings. Nor are bolts or nails used even to lock the standard 6-ft. cubes of filling to the tower frame. Thus the redwood pieces can expand and contract freely and hence not get out of alignment. There is no excessive resistance to air flow since in the double-flow tower air travels horizontally through the horizontal filling.

All parts requiring regular inspection or servicing are easily accessible by way of stairs, walks or access doors. Fan motors are located on the floor of the topdeck at the side of the fan rings, handy for servicing and outside the humid stream of discharge air. The fan rings are widely flared at the bottom to ease air flow, and are unusually high to act as guards as well as give the effect of a chimney to boost the expelled air away. All parts of the primary water distribution system are within open view and reach, while in operation, for easy examination or adjustment. Controls of the secondary or redistribution system, the air bypass dampers, and the heat exchangers themselves are reached from the ground outside or from walks on either side of the center partition running lengthwise of the tower. Access to drift eliminators and inner cubes of the filling is through the suction chambers. The air-inlet louvers fit into channels at each end which permits them to expand and contract without warping or buckling, and also permits them to be instantly removed. Removal of the louvers exposes the outer cubes of the filling. Thus there is no part of the tower which could conceivably need to be examined or dismantled which cannot be reached readily and taken apart with the simplest of tools or none at all. Since every part and detail of every tower is identical, a safe inventory of replacement items is quite small and there is no need to keep a specific stock at every location.

Phillips C. Salman, of Bronxville, N. Y., has been appointed assistant comptroller of Socony-Vacuum Oil Co., Inc., to succeed **F. R. Ficken,** who will retire December 1. Salman, with the company since 1919, has been general auditor for the last 3 years. **E. J. Glocke** will become general auditor and **W. V. Carver** assistant general auditor December 1.

Milton H. Hobbs has left Los Angeles for an assignment with the drilling department of New Zealand Petroleum Co. For the past 2 years he was with Baker Oil Tools, Inc., and before that with the Standard Vacuum group in Sumatra.

H. J. Wilson, of Tide Water Associated Oil Co., has been appointed manager of the marine department succeeding **George Zeh,** who recently retired.

Modern Big-Inch Construction Practices Applied to Tennessee Line

by Paul Reed

TO meet the various requirements for transmitting natural gas from Corpus Christi, Tex., to connections in Kentucky and West Virginia, Tennessee Gas & Transmission Co. found it necessary to lay pipe along a 1,265-mile route which is more difficult than that of any system of comparable length. Extensive swamps, as well as the more spectacular mountain areas, presented obstacles to progress. In certain localities the route of the line was changed to take advantage of terrain but it mostly followed the survey and right-of-way acquired from Hope Natural Gas Co. at the start of the project. The Hope right-of-way extended approximately 720 miles westward to Arkansas.

For building the line at a rate which would insure completion in time to transmit gas for cold-weather needs, records were broken in the amount of equipment assembled for construction crews which at one time included 25 main-line spreads, 10 river-crossing spreads, four aerial-bridge crews, seven station-construction gangs and crews laying field lines. In spite of the unusual amount of wet weather, work has progressed close to schedule. On a peak day early in August, 16 miles were backfilled by all spreads. The rate of pipe laying is indicated by the monthly records. Before February 1944 only a few joints had been laid at river crossings. From then on the miles laid each month were as follows: February, 9; March, 23; April, 44; May, 117; June, 209; July 315; August, 303; September, 187; and October, 48.

To accelerate progress new procedures were developed and several practices previously in use were revamped. Among these were pressure welding, cold machine bending, internal-hydraulic-clamp lineup and two or three-stage ditching. Development of methods in connection with the Tennessee line will advance construction efficiency of future projects.

Ditching Practices

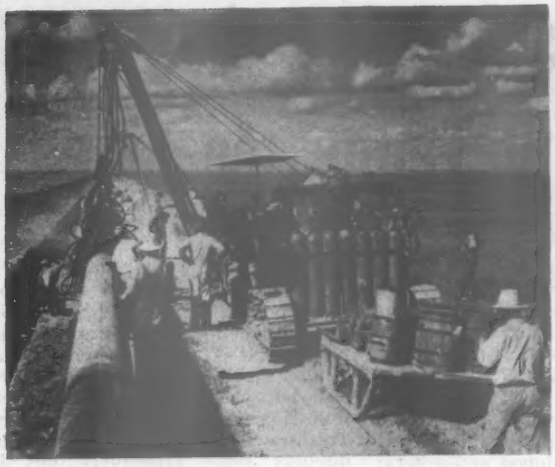
In discussing these in the order in which they may be observed at a spread, mention should first be made of the extent to which two-stage ditching was employed along the entire line. In some localities even three-stage ditching was done. This practice usually meant having a pilot ditcher dig a shallow, narrow ditch 30 in. wide and 20 to 26 in. deep ahead of the ditcher or ditchers following to complete a trench of the specified 40-in. width and of sufficient depth for 30-in. cover for 24-in. pipe. The pilot ditcher of a smaller size was commonly only 200 to 300 ft. ahead of the main ditcher following to complete the trench. This practice not only used the large ditchers more effectively but it saved avoidable wear by eliminating much "roading." Over some terrain two-stage ditching was reported to have increased the digging rate 50 per cent. For furrowing ahead of ditchers rooters were used in a few places; but rooters were primarily for right-of-way work.

Certain contractors attained greater flexibility in ditcher operation either by modern equipment or by revamping standard machines so that the speed of the digging wheel could be varied in relation to the speed of the track. This feature enables the operator to slow down the speed of the wheel when desired in order to meet changes in the material handled. This was especially advantageous in rocky ground. Economy and effectiveness of some ditchers were improved by replacing gasoline engines with diesel engines of greater horsepower.

In mountain areas where common labor was scarce, much digging that would ordinarily be hand work was done by bulldozers, draglines and back hoes.

The economy inherent in the stovepiping method has apparently been demonstrated conclusively because it has been employed along

Right: Coating-and-wrapping machine with a Bechtel-Dempsey-Price spread in Kentucky. Below: Cold bending machine



Left: Pressure welding on N. A. Saigh Co. section in Texas. Right: Welding in Kentucky; pipe is lined up by internal hydraulic clamp

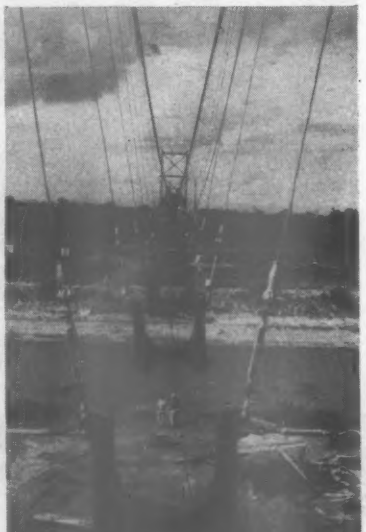
the entire Tennessee project. Some advantage is reported in certain localities from handling pipe in double joints of 80-ft. lengths.

Bending was all done by cold wrinkle bending accomplished by machines in accordance with company specifications, successfully establishing a new practice in gas-line construction which will probably replace fire bending in the industry. During construction of the line, Crutcher-Rolfs-Cummings improved machine equipment so that the cold-bending operation is much simplified. Williams Brothers Corp. and J. R. Horrigan Construction Co. used bending machines they had developed themselves. With all types of machines the process is essentially one of making a bend of 2° or 3° per wrinkle, formed at a slot permitting the wrinkle to protrude outward through it at the inner surface of the bend. Wrinkles are made at 3-ft. intervals. Where cold bending could not be done at a sufficiently acute angle to meet requirements, factory bends were used when they were procurable. The cold wrinkle bending by machines insures elimination of weak spots on the line which would result from changes in pipe metal under the high temperatures of fire bending.

Internal-Line-Up Clamp

To meet problems presented by thin-wall pipe which is frequently somewhat oval when it lies on the right-of-way, the Price-Elliott hydraulic inside lineup clamp has been designed which was used extensively on the Tennessee line by Bechtel-Dempsey-Price and other contractors. It is claimed that, through its use, laying operations were speeded up approximately 25 per cent in comparison with common methods. By employing the inside clamp it is said the first bead can be completed in 4 minutes. By hydraulically expanding three segments inside the pipe, the joint inside the pipe is absolutely smooth. If there are any offsets because of variation in wall thickness of the two joints, the offsets are on the outside. Since the welders are not obstructed by any outside equipment, they can complete the first bead without having to make a multiple number of tacks and consequently better welding is possible. Waste in cutting off many damaged ends may be eliminated. So far the inside clamp has been used only with conventional arc welding but it is reported to be potentially useful in pressure welding, also.

Coating and wrapping machine with Williams Brothers Corp. spread in Tennessee



Aerial bridge ready to receive pipe over Brazos River, Texas

On sections in Texas totaling 310 miles of 24-in., pressure welding was done under subcontracts from general contractors to Pressure Weld Co., because it had been demonstrated that pipe could be laid faster and cheaper this way. In carrying on the work with two shifts of 7 and 8 hours each, working 14 and 15 hours a day it was found that efficiency could be increased. Where this policy was followed, a high daily output for two shifts was 210 24-in. welds or 8,400 ft. of welded line in 1 day.

Pressure Welding

Special attention was found to be advisable in preparing pipe for pressure welding to insure that the pipe be free of dirt and that ends be ground by equipment driven by current from a 1,500-watt electric generator. Straightening of damaged ends is important. A crew for lineup and welding operations consists of 12 men and a crew of swampers to handle skids.

The principal operations are performed with one tractor for lining up the pipe and another for manipulating the pressure-welding equipment. Heat is applied by oxy-acetylene jets applied simultaneously around the pipe, the ends of which

have been beveled 9° at the mill for this type of construction. At the beginning of heating a total pressure of approximately 4,000 lb. is applied. After 1½ minutes, the ends of the joints are sufficiently hot for the next step in which the operator of the welding tractor throws two levers to suddenly apply hydraulic pressure of 16,000 lb. Because of the nature of the process neither the time taken in welding nor the number of men directly engaged in the operation is increased when larger-diameter pipe is laid.

One of the spreads in Texas operating with pressure welding had the following equipment in addition to that used for welding: 1 ditching machine; 1 back hoe; 1 drag line with clam shell; 18 tractors; 2 cleaning machines; 1 priming machine; 1 coating machine; 25 trucks; 25 light delivery trucks (pickups).

A total of 955 miles of 24-in. and 20-in. including 46 miles in Texas were welded by the conventional arc welding method. Preparatory to welding, joints were spaced 0.04 to 0.065 in. Following the making of the stringer bead by two welders, it was common practice to have welding completed by eight bell-hole welders. Stringers beads were made with 5/32-in. rods and other beads with ⅛-in. rods.

Coating and wrapping were done by modern efficient power-driven mechanical equipment. In hot weather, when the priming coat dried within 3 minutes, coating and wrapping operations were observed to follow 600 to 700 ft. behind the pipe cleaning and priming. On some parts of the line where the pipe was heavily rusted, two cleaning machines in succession were necessary for a complete job.

The pipe was laid in the ditch with four or five slack loops per mile. Loops were suspended from slings in such a way that there would be the correct amount of slack for snaking in the ditch. Lowering in was frequently done by four or five tractors. Backfilling was mostly accomplished by bulldozers.

In many areas along the Tennessee system stringing of pipe was difficult. Loads were usually of five joints each, totaling 6½ tons.

When the Red River crossing was being laid the stream was only about 50 ft. wide and had a considerable flow of water. Sand bags were placed upstream and an earthen dam downstream. River water was brought across the dammed area through three 40-ft. joints of 24-in. pipe. Most of the water was controlled by the dams and the pipe so that one pump had sufficient capacity for lifting water from the river bed.

At rivers like the Cumberland where the bottom was solid rock, shot holes were drilled by portable rigs of a water-well type mounted on barges; 6-in. shot holes were drilled through old casing into the rock to a depth of 12 ft.

At river crossings pipe was ballasted by 2,400 to 2,800-lb. river clamps at 14 to 20-ft. intervals; pipe was double coated and wrapped and given an outside protection of 1-in. wood slats, 2 to 3 in. wide.

Maintenance of the line will be handled by seven gangs under the direction of division offices at Bowling Green, Ky., and Houston.

In building the Tennessee project advantage has to be taken of improvements in big-inch construction in the last 2 years. Various advanced methods employed in laying it represent important departures from methods which have been regarded as standard for nearly 10 years.

Tennessee Company Executives

For handling special problems entailed in wartime construction, Tennessee Gas & Transmission Co., at the start of the pipe line, acquired the services of E. C. Link, Jr., as traffic manager who came from War Emergency Pipelines, Inc.; N. W. Freeman, personnel director; Charles A. Lingo, assistant manager of land department, and Marshall F. Lerch, chief engineer.

Congratulations

TO THE

TENNESSEE GAS AND TRANSMISSION COMPANY

J. R. HORRIGAN
CONSTRUCTION CO.
PIPE LINE CONTRACTORS

Commerce Bldg.
Telephone Capitol 5534

HOUSTON,
TEXAS

Engineering Design Of Tennessee Line

(Continued from page 109)

are purchase-gas-meter stations, sales-meter stations and check-meter stations.

The three initial purchase-gas-measuring stations are located in Nueces County, Texas. Each of the purchase-gas-measuring stations at the Wardner and Gulf Plains cycling plants is equipped to operate under the initial design of the transmission system at a capacity of 100,000,000 cu. ft. of gas per day at a pressure base of 16.7 p.s.i. The measuring station at the Coastal cycling plant operates under the initial design of the transmission system at a capacity of 25,000,000 cu. ft. of gas per day at a base of 16.7 p.s.i.

There are three sales-meter stations on the system, two for deliveries to the United Fuel Gas Co. and one for the delivery to the Hope Natural Gas Co. The station located at the discharge of No. 14 compressor station is to deliver gas to the United Fuel Gas Co. at a pressure of 475 p.s.i.g. and is designed to handle between 35,000,000 and 45,000,000 cu. ft. of gas per day at a pressure base of 15.025 p.s.i.

Two of the sales-measuring stations are located near the point at which the 20-in. main line pipe crosses the United Fuel Gas Co.'s S-7 12-in. line near Clendenin, W. Va. One of these stations is designed to deliver gas to the United Fuel Gas Co. at a pressure of 475 p.s.i.g. and at a capacity of 55,000,000 to 65,000,000 cu. ft. of gas per day at a pressure base of 15.025 p.s.i. The other station is to deliver gas to the Hope Natural Gas Co. at their Cornwell station, approximately 3 miles from this location, at a pressure of 475 p.s.i.g. and at a capacity of 100,000,000 cu. ft. of gas per day at a pressure of 15.025 p.s.i.

The three check-meter stations are located at the dehydration plant near Pintas Creek; near Grand Ecore, La., and near Dickson, Tenn.

The check-meter station at the dehydration plant not only acts as a check-meter station, but also as proportioning meters in regulating the flow of gas to the contactors in the dehydration plant. This meter station is designed to operate at a pressure of 850 lb. and has a capacity under the initial design of the transmission system of 225,000,000 cu. ft. per day at a pressure base of 14.73 p.s.i. The stations at Grand Ecore and Dickson are both designed to operate at a pressure of 750 lb. and at a capacity ranging from 225,000,000 to 300,000,000 cu. ft. per day at a pressure base of 14.73. These stations are installed on the transmission system to provide a check on the amount of gas handled and to provide a means of isolating the leakage on the system.

The gas used as fuel at the plants and in the cottages will be measured. Proportioning meters will be placed on the scrubbers at the inlet of each compressor station to distribute the load to the scrubbers and charts from the proportioning meters can be used as a station operating control check on the flow of gas into the plant.

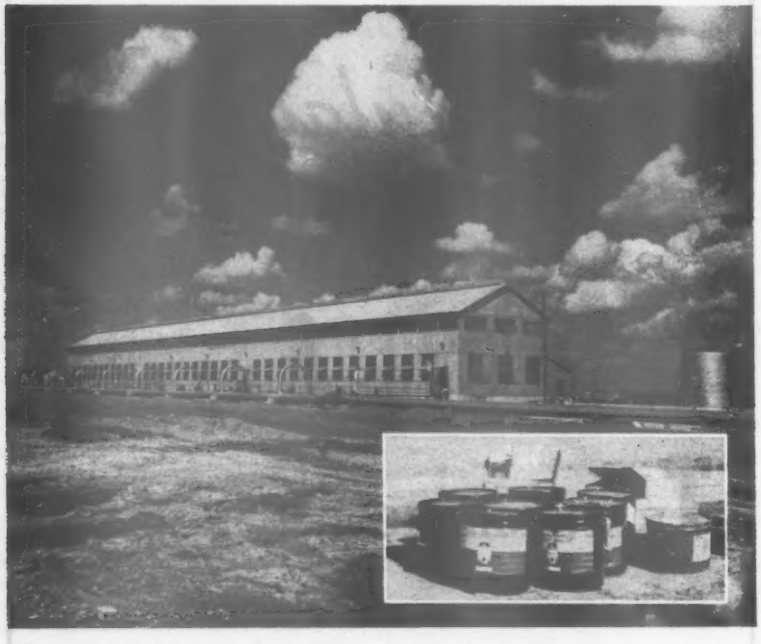
River Crossings

On the minor and less hazardous streams a single submerged crossing is used, in which the outside pipe diameter will be the same as on the main line but will have a wall thickness of ⅜ in.

On navigable and hazardous streams multiple submerged line crossings will be used, in which the crossing on the 24-in. section of the main line will consist of three 16-in. by ⅜-in. pipe lines and on the 20-in. section of the main line consists of two 16-in. by ⅜-in. lines connected on both sides of the river by valves into the headers.

On hazardous streams which lend themselves to aerial suspension crossings the pipes are suspended across the river by the use of cables.

The Mississippi River is crossed by hanging two 16-in. lines with aluminum alloy structural forms on



CONGRATULATIONS to

TENNESSEE GAS & TRANSMISSION CO.

on the completion of this outstanding pipe line

Naturally we are proud that Horn Paints and Technical Coatings were selected and used on all the station and storage tanks on this great pipe line. The successful completion of this outstanding project reflects the highest credit on all executives, engineers, purchasing agents—all men, both supervisors and workers who have worked together in such effective cooperation.

HORN

A. C. HORN COMPANY

Petroleum Division Headquarters

HOUSTON, TEXAS

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SOLD THROUGH LEADING SUPPLY STORES EVERYWHERE

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Built to Specifications
For
THE TENNESSEE GAS AND TRANSMISSION CO.
PIPE LINE

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Also We Have Furnished Clamps For Many Pipe Line Jobs Including

THE BIG INCH
THE LITTLE INCH

—●—

SEND US YOUR SPECIFICATIONS
ON YOUR NEXT JOB

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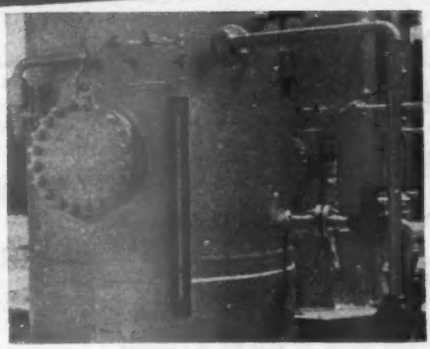
Martinsville, Ill.

A TRIMOUNT INSTRUMENT FOR EVERY JOB



Trimount manometers, flow meters, electronic devices, and other instruments are the careful choice of war plants and industries to accurately measure performance of their equipment.

Pictured is a Trimount U-Tube Manometer used by Tennessee Gas and Transmission Co. to measure rate of flow to scrubbers in their new pipe line at Monroe, La.

A complete line of U-Tube and Well Type Manometers; Inclined Manometers; Draft Gauges; Indicating Flow Meters; Pitot Tubes; Tank Liquid Level Gauges; Micro-Manometers, and Sight Feed Bubblers.

Electronic devices include: Dynamic Pressure Gauges; Liquid Level Controls; Electronic Pressure Controls; Bin Level Controls, and Pressure Cutoff Switches.

Write for information.

Trimount Instrument Company
37 W. Van Buren St. Chicago 5, Ill.

Another big pipe line field-wrapped

by J-M MACHINES with J-M ASBESTOS FELT!

● The 1263-mile, 24-inch natural gas pipe line of the Tennessee Gas and Transmission Company will be in operation next month. The line—one of the largest of its kind in the world—was coated and wrapped right in the field in a single operation . . . by the ingenious mobile Johns-Manville power-driven Coating and Wrapping Machine.

And, as in the case with many other large pipe lines, including "Big Inch", this pipe is wrapped with Johns-Manville Asbestos Pipe Line Felts. For hundreds of miles through water, mud, and corrosive soil, these lasting, rotproof felts safeguard its protective coatings against soil stress.

A better job—in less time . . .

For full details on how the J-M Coating and Wrapping Machine and J-M Asbestos Pipe Line Felts can guard your own lines against corrosion—and save you time and money in your pipe-wrapping operations—write Johns-Manville, 22 E. 40th Street, New York 16, N.Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville
Asbestos
PIPE LINE FELTS

the highway bridge near Greenville, Miss.

Highway and Railroad Crossings

Approximately 274 highway and 62 railroads are crossed by the pipeline system. The system design called for boring of all hard-surfaced highways and railroads, and casing the line with 28-in. o.d. steel pipe. The 28-in. o.d. casing will be closed at each end with a Dresser coupling and it will be vented as required by the various states and railroad authorities. All county highways and side roads will be ditched where permissible and such crossings will be cased and vented whenever required.

Communications System

The communication system consists of a single talking circuit leased from the American Telephone & Telegraph Co. There is a PBX termination at the main office and a standard telephone termination at each of the compressor stations, the northern division headquarters at Bowling Green, The Chicago Corp. office at Corpus Christi, the dehydration plant, each of the three delivery stations and at the toll bridge office of the Greenville, Mississippi River Bridge.

Local telephone service is available at each of the compressor stations, the main office and the dehydration plant.

Employe Housing

Twenty-seven houses are built at the compressor stations and the dehydration plant. There are four houses at Nos. 2, 4, 8, 10, 12 and 14 stations, and two houses at No. 6 station, and one house at the dehydration plant.

Specifications of Pipe Steel

The 24-in. o.d. National seamless line pipe, 9/32-in. wall thickness, theoretical weight 71.25 lb. per ft., was manufactured in accordance with A.P.I. specifications, 5-L Grade B pipe except as follows:

Minimum physical properties:	
Yield point (lb.)	45,000
Tensile strength (lb.)	70,000
Hydrostatic test (p.s.i.) (72 per cent of yield point)	950
Random lengths average (ft.)	40

Chemical limitations:	Per cent
Carbon	not over .30
Manganese	.35 — 1.50
Sulfur	not over .06
Phosphorus	not over .045

The 20-in. o.d. National seamless line pipe, 9/32-in. wall thickness, theoretical weight 59.23 lb. per ft., was manufactured in accordance with A.P.I. line-pipe specifications, 5-L Grade B pipe except as follows:

Minimum physical properties:	
Yield point (lb.)	45,000
Tensile strength (lb.)	70,000
Hydrostatic test (p.s.i.) (72 per cent of yield point)	1,140
Random lengths average (ft.)	40

Chemical limitations:	Per cent
Carbon	not over .30
Manganese	.35 — 1.50
Sulfur	not over .06
Phosphorus	not over .045

The specifications for the 24-in. o.d. A. O. Smith electrically welded pipe, ¼-in. wall thickness, theoretical weight 63.413 lb. per ft.:

Minimum physical properties:	
Yield point (lb.)	50,000
Tensile strength (lb.)	70,000
Hydrostatic test (p.s.i.) (72 per cent of yield point)	940
Random lengths average (ft.)	40

Chemical limitations:	Per cent
Carbon (maximum)	.30
Manganese	.95 — 1.25
Phosphorus	not over .045
Sulfur	not over .050

The steel from which the pipe is made conformed to the following minimum requirements as to tensile properties:

	(Pounds)
Tensile strength	70,000
Yield point	41,250

Each length of pipe was hydraulically expanded within dies to produce the nominal outside diameter of the pipe. The pressure required produced a hoop stress in the circumferential direction not less than the 50,000 p.s.i. minimum specified yield point in the finished pipe.

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REFINING

District 3 Oil-Exchange Regulation Revised

WASHINGTON. — The Petroleum Administration for War October 24 issued a formal directive (Petroleum Directive 78), which replaces Revised Plan 15. The directive provides for sales, exchanges, and loans of crude oil and petroleum products by and among petroleum refiners in the Southwest.

The directive also provides for the joint use of facilities by petroleum operators and sets up and defines the functions of certain industry committees.

The formal directive is substantially the same as the Revised Plan 15, which was issued in August 1942 to meet wartime emergencies among petroleum refiners and transporters, PAW officials explained. Primary purpose of issuing the directive is to simplify and clarify the provisions of the plan. The directive is applicable only in PAW District 3 which comprises Alabama, Arkansas, Louisiana, Mississippi, New Mexico and Texas.

Gulf Coast Plants Run at Record-Throughput Rate

HOUSTON.—Gulf Coast Refiners Association reports for the first half of October 1944 indicate crude-oil throughput of 122,827 bbl. a day, maintaining the recent high levels. Crude runs were at 87.7 per cent of rated capacity and represent an increase of 23,398 bbl. daily in comparison with operations of 82 per cent of capacity a year ago when the group processed 99,429 bbl. a day. Two years ago crude runs were 104,121 bbl. daily.

Stocks of all grades of gasoline increased during the first half of October by 147,675 bbl., the entire increase being in aviation-grade gasolines earmarked for the military, and were reported at 1,554,766 bbl. A year ago total gasoline stocks were 1,629,836 bbl. while the stockpile 2 years ago was 2,352,558 bbl. or 797,792 bbl. above present inventory. Automotive gasoline considered alone was 413,139 bbl. on October 15 showing a decrease since October 1 of 64,082 bbl. which reflects extremely low inventory of this product. This total represents about 55 per cent of the 745,652 bbl. of automotive gasoline in storage a year ago, but it represents only 29 per cent of the 1,415,859 bbl. of automotive gasoline reported on October 15, 1942, when such stocks were considered about normal.

Total stocks of all products in the plants of the GCRA group were reported at 4,174,375 bbl October 15 showing an increase of 512,232 bbl. during the first half of the month. A year ago total products stocks were 3,542,552 bbl. while stocks of all products at this time 2 years ago were 5,867,838 bbl. and were then considered about normal.

Liquid-Fuels Research Centered in Pennsylvania

WASHINGTON. — Plans for the construction of a synthetic liquid fuels research and development laboratory by the Bureau of Mines at Bruceton, Pa., south of Pittsburgh, were announced last week by Secretary of the Interior Harold L. Ickes, following a conference here, at which the bureau's long-range study of producing gasoline and other essential fuels from coal and oil shale was discussed.

Secretary Ickes said that the various structures comprising the large laboratory—the most modern of its type in the world—should be ready for occupancy by the fall of 1945. The various units in the laboratory and other facilities will occupy about

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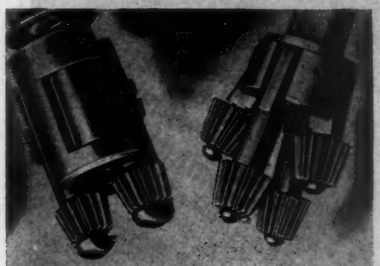
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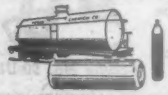

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7 acres and will include three large buildings, each three stories high, a power house, and several smaller service buildings.

In announcing the latest development in the Bureau of Mines research program, Secretary Ickes emphasized that the laboratory, to be known officially as the Research and Development Laboratory for Synthetic Liquid Fuels, should not be confused with demonstration pilot plants that the bureau will build later to demonstrate two methods for producing gasoline and other valuable products from coal.

The laboratory will work out the "kinks" in the various processes to be studied, he explained. It will serve two purposes: First, to reduce the cost of constructing the larger-size demonstration plants and, second, to improve the methods of producing liquid fuels from coal so that the demonstration plants will be the most modern that can be built and operated.

Dr. R. R. Sayers, Bureau of Mines director, and others who mapped the synthetic liquid fuels research program at last week's sessions in Washington reported that the extensive laboratory facilities at Bruceton will be used to develop improved techniques over those now employed in England and Germany.

Heading the research and development laboratory will be Dr. H. H. Storch, recently named chief of the research and development division of the office of synthetic liquid fuels. Dr. Storch, who went to England last year to study synthetic liquid-fuels processes, now is stationed at the central experiment station at Pittsburgh. Dr. Storch said that the laboratory will employ approximately 280 persons when completed and that approximately half will be technical personnel.

List of Critical Oil Products Revised

WASHINGTON.—The list of critical products, which is issued from time to time as a guide for the nation's refiners, was revised last week.

Deputy Administrator Ralph K. Davies said that as a result of shifting aviation gasoline of 87-octane and below and 80-octane all-purpose gasoline from Group 2 to Group 3 on the list, certain refineries that were previously rated as war plants will now lose this classification.

The changes in the list, which last was issued July 15 are: (1) Gasoline base stock of 91 or better octane number, which is to be used in the 100-octane blending program, is shifted from Group 1 to Group 2; (2) aviation gasoline of 87-octane and below is shifted from Group 2 to Group 3, and (3) 80-octane all-purpose gasoline is shifted from Group 2 to Group 3.

Included in Group 1 (first preference and critical) are: Alkylate, hydrocodimer, codimer, isobutane, B-B cut, isopentane, toluene used by Army ordnance, butadiene, petroleum synthetics, and hydroformate and toluene used in aviation gasoline.

Lloydminster Refineries to Install Dehydrating Unit

LLOYDMINSTER, Alta. — R. L. Shaw, president of Lloydminster Refineries, has announced that his company will install a dehydrating unit with capacity of 1,200 bbl. a day, to clean and process the Lloydminster crude for use as fuel oil in locomotives. The refinery will be enlarged to 750 bbl. capacity by installation of tube still and tower, and 6,000 bbl. storage is being added.

Rules Removed From Oil Used in Spraying Coal

WASHINGTON. — Petroleum Distribution Order 13 has been amended to permit the use of any grade of fuel oil for coal-spraying purposes. Previously, only Nos. 5 and 6 and Bunker C fuel oil, asphalt, and asphaltic products could be used to spray coal.

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PIPE LINES

Tennessee G. & T. Co. Line Completed and Operating

Tennessee Gas & Transmission Co. completed the 1,265-mile system of 24-in. and 20-in. pipe from the Corpus Christi, Tex., area to Cornwell, W. Va., early this week. Soon after the final weld was made deliveries of gas began at eastern connections.

The last construction work was done in a rough section in Tennessee where the company concentrated a large amount of construction equipment and manpower during the past week in order to provide for finishing the last few miles as rapidly as possible. Pigging and blowing operations were carried on toward the close of the undertaking so that the line would be ready to go into operation shortly after the final weld was made.

The program of the company calls for operating the line continuously for 2 weeks before checking facilities during a 48-hour shutdown.

Gas for the $54,000,000 Tennessee company system, according to the present schedule will be drawn from The Chicago Corp., owning and controlling in excess of 2 trillion cu. ft. of reserves, and from Gulf States Oil Co. with reserves of approximately 1 trillion cu. ft.

The Chicago Corp. has a controlling interest in Tennessee Gas & Transmission Co. Contrary to press reports that The Chicago Corp. is a "Marshall Field company," Field owns less than one-fifth of 1 per cent of the capital securities of The Chicago Corp., is not a director and is in no way connected with its policies or management, according to recent statement made by the Tennessee company.

WEP Increases Products Flow From Lake Charles

Movement of refined products from Lake Charles, La., refineries through the War Emergency Pipelines, Inc., feeder line to Beaumont, Tex., has been increased from 25,000 to 40,000 bbl. daily as a result of installation of additional pumping equipment completed last week. The new equipment consists of two electric centrifugal units, one of which has been installed at the Lake Charles pump station and the other at the newly constructed Echo station, halfway between Lake Charles and Beaumont, where products enter the 20-in. line through which they are shipped to Linden, N. J.

Tennessee Division Superintendents

In planning the operating program, Tennessee Gas & Transmission Co. has appointed superintendents for the two divisions which will be divided by the Mississippi River. Tod Pazdral will supervise the southern division from company headquarters at Houston. B. J. Davis in charge of northern division will be located at an office of the company established at Bowling Green, Ky. Both Pazdral and Davis had an active part in the laying of the recently completed system of the company.

Jones & Brooks Plans For New Equipment

In disposing of equipment Jones & Brooks, Dallas, pipe-line contractors, sold a large part of the firm's equipment to Fabick Tractor Co., Salem, Ill. It is reported that much of this equipment was later sold to Eastern Construction Co.

In preparing for work next year, Jones & Brooks has arranged for new diesel equipment to be delivered early in 1945.

River Crossing Protest Delays Colonial-Beacon

Progress of the project for laying 34 miles of 4-in. and 6-in. by Colonial-Beacon Oil Co. from Everett to Methuen, Mass., has been delayed by a protest from the city of Lawrence, Mass., against permitting the line to be laid across the Merrimac River on the basis that the municipal water supply would be contaminated if the line should break.

At a hearing called on the petition of the Colonial-Beacon company, Scott Drummond, engineer, Standard Oil Co. of New Jersey explained how the line could be laid so as to avoid corrosion and stated

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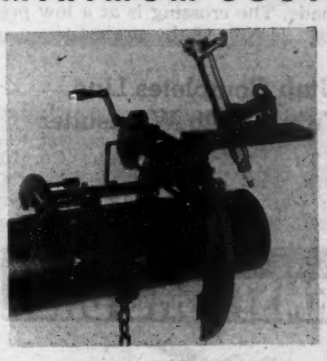

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that only severe flood conditions might cause a break in the line.

It is reported that a request from the city of Lawrence to refuse permission for the pipe-line river crossing will be denied by Army engineers to whom the protest is being made. The crossing is at a low pressure section of the project.

Utah Completes Line From Iles to Wamsutter

The Utah Oil Refining Co. 108-mile 6-in. line from the Iles field to Wamsutter, Wyo., where it connects with the company's trunk line from eastern Wyoming to Salt Lake City, has been completed. The company began running oil for the first time on October 25; oil is expected to reach Wamsutter this week. It was built by the Stanolind Pipe Line Co. Same interests have pending before the Colorado Public Utilities Commission an application for an extension of this line to the Rangely field in Rio Blanco County, Colorado.

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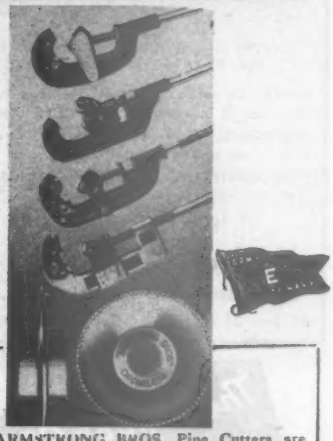

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Northern Natural's New Station Nearly Completed

The 5,200-hp. compressor station near Beaver, Okla., which is under construction for Northern Natural Gas Co. and contracted by Midwestern Engineering, will be completed within 10 days. This contracting firm is also nearing completion of facilities to enlarge the system of Illinois Central Gas & Electric Co. at Rockford, Ill., where 6,000 ft. of 6-in. remains to be laid.

Oklahoma Natural Plans $1,500,000 Program

Oklahoma Natural Gas Co. is launching a new construction and improvement program for 1945 involving the expenditure of over $1,500,000, it was announced by Joseph Bowes, president, following approval of the program by directors.

The construction and improvement projects are being undertaken not only to meet present requirements, but also in anticipation of Oklahoma's growth and development in the postwar era.

Construction of transmission lines to reach new gas supplies, additional compressor stations, replacements of lines and installations because of obsolescence, and other transmission construction for improvement of service will total $566,000.

Distribution construction and improvements call for an expenditure of $531,000, while general construction projects will cost $100,000, making a total for all projects of over $1,500,000.

The extensive program provides for production installations totaling $354,000 for drilling and equipping new gas wells and the installation of additional equipment for existing wells.

WEP 20-In. Products Throughput Increased

The increased throughput of the War Emergency Pipelines, Inc., 20-in. refined products line is indicated by pumpings for the period of October 14-20 when an average of 217,874 bbl. daily was moved from Beaumont, Tex.; 218,171 bbl. daily from Norris City, Ill.; and when 218,234 bbl. were delivered to purchasers in the New York area.

The WEP 24-in. shipments of crude oil in the same period averaged as follows: From Longview, Tex., to Norris City, 320,406 bbl. daily; from Norris City to the East Coast, 303,275 bbl. daily, of which 147,958 bbl. were delivered to Philadelphia refineries and 154,710 bbl. daily to refineries in the New York area. Deliveries to Ohio Oil Co. at Enfield, Ill., averaged 21,534 bbl. daily.

During the week ended October 18, the Southwest Emergency line pumped at Heard station an average of 79,319 bbl. daily from the Corpus Christi, Tex., area to connections at Houston.

Kansas-Nebraska Project Is Completed

Construction involved in the expansion program of Kansas-Nebraska Natural Gas Co., estimated to cost $2,343,000 has been completed. The undertaking included the laying of 156 miles of pipe, of which 41 miles is 18-in., 100 miles is 12¾-in. and 15 miles is 8⅝-in. Compressor capacity was increased by four 500-hp. units.

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Exploration and Drilling

Week's Highlights

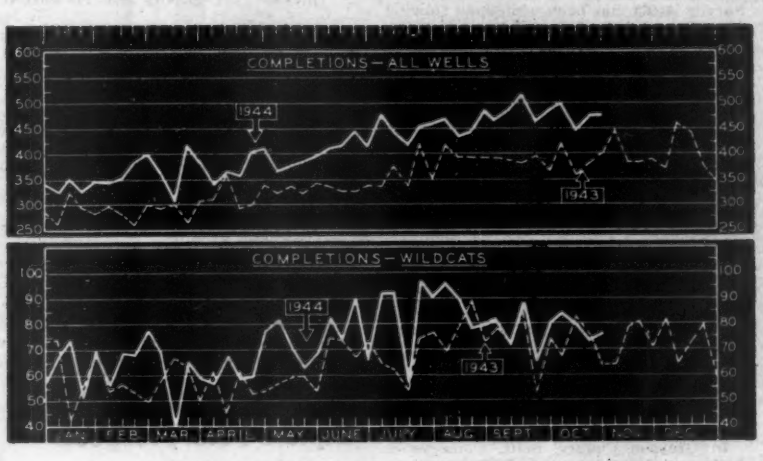
MANY oil men, operating outside the Rocky Mountain region, have just about fixed in their minds, the approximate location of the Big Horn basin in Wyoming, with the mental tag that this geological basin is going to be the center of extensive oil-field finding and development over the next few years. They may as well start now to enlarge that mental pigeon hole and add the Wind River basin, which lies south of the Big Horn, and is separated from it by the Owl Creek Mountains.

In 32n-95w, Fremont County, Wyoming, the Big Sand Draw gas field produces from the Frontier sand, on a structure with a proven closure of 1,300 ft., which had never been tested below the Morrison. Under a unit agreement, Sinclair-Wyoming et al pooled about 2,000 acres and started a Tensleep test known as 1 Unit, SW NW NW 14-32n-95w.

This test has now found saturation in the Embar at 6,896-6,913 ft., and on a 57-minute drill-stem test, got 1,560 ft. of oil, 633 ft. of oil-cut mud, and 90,000 cu. ft. of gas. The oil tested 32.5° gravity and is sweet. Most of the Tensleep oil previously found in the Big Horn basin is substantially lower in gravity. The test will probably continue to the Tensleep before final completion.

Prior to the Big Sand Draw development, two Tensleep discoveries had been made in the Wind River basin this year at Steamboat Butte in 31-4n-1w, on the west side of the basin, pay zone at 6,772-7,034 ft., and at Spindletop in 32-30n-81w on the east side of the basin, where the pay zone is at 2,224-68 ft. The Big Sand Draw discovery will call for tests of the structure producing gas at the Muskrat field in 34n-92w, 18 miles northeast; the Beaver Creek area in 33n-96w, 10 miles northwest; and the Alkali Butte structure, in 34n-95w, 10 miles to the north, none of which has been tested in either the Embar or the Tensleep.

The Big Sand Draw field is along the western rim of the basin, which is roughly outlined from north to south by the following fields: Circle Ridge, Maverick Springs, Steamboat Butte, Lander, etc. The eastern rim is outlined from south to north by Bolton Creek, Spindletop, Poison Spider, Powder River and Notches fields.



Solid line charts current weekly completions

COMPLETIONS IN ALL FIELDS . . .

Week ended October 28, 1944

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1944	1943
N. Y., Penna., W. Va.*	58	21	5	84	141,927	2,890	2,839
Ohio	6	7	8	21	49,069	831	765
Indiana	3	0	5	8	18,451	213	186
Kentucky	6	2	7	15	30,170	617	376
Illinois	28	0	20	48	122,944	1,558	1,473
Michigan	6	3	7	16	41,519	552	501
Kansas	20	0	23	43	149,483	1,504	1,373
Nebraska, Missouri, Iowa	1	0	0	1	1,397	33	43
Oklahoma	23	3	5	31	163,353	1,481	968
Texas:							
North Central	18	0	15	33	66,991	1,203	1,226
West	26	0	7	33	159,290	1,300	737
Panhandle	10	1	1	12	38,993	228	150
Eastern	2	2	1	5	31,094	264	239
Gulf Coast	18	4	7	29	184,987	1,040	383
Southwest	1	0	5	6	22,923	567	760
Total Texas	75	7	36	118	504,278	4,602	3,495
Louisiana:							
Northern	2	6	0	8	36,419	264	261
Southern	4	0	2	6	45,542	392	298
Total Louisiana	6	6	2	14	81,961	656	559
Arkansas	4	0	1	5	25,117	181	214
Mississippi	2	0	1	3	16,992	118	78
Southeastern States	0	0	2	2	13,997	44	†
Montana	2	0	1	3	11,125	295	193
Wyoming	3	1	0	4	13,989	143	117
Colorado-Utah	0	0	1	1	2,035	30	21
New Mexico	12	1	3	16	44,977	330	192
California	36	0	7	43	156,758	1,654	1,119
Total United States	291	51	134	476	1,589,442	17,730	14,512
Total previous week	270	42	165	477			
Total Oct. 30, 1943	225	59	109	393			

*Does not include 52 pressure wells. †Included in total shown for Mississippi.

N. CENTRAL TEXAS

Mississippian Discovery Flows 11 Bbl. Per Hour

WICHITA FALLS. — Hanlon - Buchanan, Inc. 1 C. M. Matlock, Jack County wildcat 5 miles south of Jacksboro, and in southwest corner of the A. H. Latimer Survey A-363, has been completed flowing 68 bbl. of oil in 6 hours through ¼-in. choke, gas-oil ratio 1,750 to 1, from Mississippian lime pay, after using 1,000 gal. acid in pay zone between 5,316-44 ft., total depth.

Salt water intrusion continued to hamper efforts to complete The Texas Co. 1 Rasure, Cooke County wildcat north of Sivel's Bend. On its latest test, with perforations at 6,760-68 ft., opposite Strawn sand, it started off swabbing 6 bbl. of clean oil per hour, then water broke in and during the next 22 hours it swabbed 63 bbl. oil and and 42 bbl. salt water.

Southwest of Bowie in Montague County, Continental Oil Co. 1 McNutt, Viola lime discovery, was shut in to dismantle rig following its last gage of 47 bbl. of oil and 2 bbl. water in 12 hours through 12/64-in. choke, tubing pressure 175 lb., casing 1,150 lb. A new 4,200-ft. wildcat in Montague County is The Texas Co. 1 L. A. Hutson, 15 miles northeast of Montague, in the northeast corner of the G. W. Fletcher Survey A-280.

In Grayson County, Seitz, Comegys & Seitz and Humble Oil & Refining Co. 1 Walling, 4 miles east of Tioga, topped Strawn sand at 1,945 ft., showed 120 ft. of salt water on drill-stem test at 3,435-42 ft., and was drilling ahead below 3,820 ft. in shale. Pure Oil Co. 1 Flowers (Little), southwest of Gordonville, was drilling past 7,735 ft. in sandy shale.

NORTH CENTRAL TEXAS WILDCAT COMPLETIONS

Archer County: Staley Oil Co. 1 Abercrombie & Taylor, Blk. 40, J. W. Harris subd., 8 mi. W and 2 mi. S Archer City, elev. 1,121 ft., pumped 35 bbl. day, gravity 41, TD 1,404 ft.

Clay County: L. T. Burns 2 Mrs. M. R. Gilbert, C. Thompson Sur. A-445, 1½ mi. S and ½ mi. W Joy, elev. 1,099 ft., dry, TD 4,084 ft.

Jack County: Ralph Harper et al 1 B. Flowers, E. M. Sanders Sur. A-534, 3½ mi. S and ½ mi. W Jacksboro, elev. 1,245 ft., dry, TD 3,249 ft.

Wilbarger County: Fain & McGaha 1 C. K. Martin, Sec. 5, Blk. 11, H&TC Sur., 3 mi. E and 1 mi. S Odell, elev. 1,398 ft., Palo Pinto 4,699 ft., IP 252 bbl. day through 20/64-in. choke, gas-oil ratio 420 to 1, gravity 39.8, TD 4,841 ft.

WEST CENTRAL TEXAS WILDCAT COMPLETIONS

Jones County: Eltex, Ltd. 1 T. A. Tucker, Sec. 13, Blk. 17, T&P Sur., 4 mi. SW Truby, elev. 1,739 ft., dry, TD 2,930 ft.

R. H. Roark et al 1 Grover C. Blair, Sec. 16, Blk. 19, T&P Sur., 5 mi. SW Noodle, elev. 1,847 ft., Noodle Creek 2,398 ft., Swastika 3,094 ft., dry, TD 3,117 ft.

Mills County: Northern Ordance, Inc. 1 C. M. Bramlet, Sec. 31, HT&B Sur., 10 mi. N Goldthwaite, elev. 1,593 ft., Marble Falls 2,665 ft., Ellenburger 2,993 ft., dry, TD 3,248 ft.

EASTERN TEXAS

Travis Peak Gasser to Explore Pettit Prospects

DALLAS.—H. C. Owen 1 Rousseau, Rusk County wildcat southeast of Henderson, Wilkerson Survey, tested estimated 3 to 4 million cu. ft. of dry gas daily after perforating casing at 7,382-89 ft., in the Travis Peak zone, and operators prepared to perforate and test the Pettit zone at 7,095-7,125 ft. The hole is bottomed at 7,512 ft.

Information released during the week showed a substantial decline in rate of production obtained by the new shallow discovery in Robertson County, Hammon Oil Refining Co. 1 Gibson, 5 miles west and south of Calvert. Originally drilled to 5,017 ft., it was plugged back to 2,194 ft., stood idle for some time, then when testing operations started it was swabbed in and flowed briefly at rate of several hundred barrels daily, but is now being tested on pump and looks good for 50 to 75 bbl. daily. It is believed to be producing from the Navarro sand. This new discovery was inadvertently reported in the Journal last week as a dry hole, with credit for the discovery bing given to Hammon 2 Gibson, located 950 ft. northeast of No. 1. The second test was drilling late last week at 1,460 ft. and had not yet reached the discovery pay zone.

H. C. Cockburn, Houston, has spudded his 1 Gilliam et al, 9 miles northeast of Marlin in Fallas County, and about 25 miles north of the new Robertson County well, with intention of drilling to the Smackover lime.

Two new deep wildcats for the East Texas basin were started last week. In Henderson County, Humble Oil & Refining Co. 1 R. A. Huddleston was located 5,720 ft. from north, 830 ft. from west lines of K. H. Douglas Survey, 2½ miles southwest of Eustace. In Van Zandt County, 2 miles southwest of Van, Lone Star Producing Co. 1 J. J. Goode, in the D. Rose Survey, was building roads.

EAST TEXAS WILDCAT COMPLETION

Panola County: Skelly Oil Co. 1 Houston Wills et al, M. A. Romero Sur., 10 mi. W Carthage, elev. 329 ft., massive anhydrite 5,230-60 ft., James 5,940-50 ft., Travis Peak 6,610-20 ft., IP 21,500,000 cu. ft. gas day open flow (est. 22 bbl. distillate per million), TD 7,006 ft.

ILLINOIS

Franklin County Wildcats Make Good Showings

CENTRALIA, Ill. — The 48 completed wells reported in the past week in Illinois fields included 28 oil wells averaging 140 bbl. per well, an unusually high average for these times. A half dozen relatively big wells were responsible for the general good showing. Fulk & Cravens completed 1 Martin heirs, SW NE NE 24-3n-8e, in the Noble pool, Richland County, in McClosky lime at 2,981-99 ft., and it flowed 491 bbl. in 24 hours, following acid treatment. Superior Oil Co. 4 W. A. Mussett, SW NE NW 12-3s-10e, in the Grayville West pool, White County, flowed 570 bbl. from Biehl and Bridgeport sands, total depth 2,003 ft. These were the largest of the better wells.

Forty-nine new operations were started, including the following wildcats: Sohio Petroleum 1 Virgil Decker, NW SE SE 22-2n-12w, and Paul Greauling 1 T. W. Case, SE SE NW 36-2n-13w, Lawrence County; B. M. Heath et al 1 Delak, SW SE SE 6-7s-8e, White County; Texas Co. 1 H. Althoff, SEC SW SW 29-1n-3w, Clinton County; H. Luttrell 1 McAndrew, C SW NE 15-10n-6e, Shelby County; Cornelius & Collins 1 Iva Wilbert, NW SW SW 31-9n-12w, Clark County; The Texas Co. 1 E. N. Ambeuhl 1, no farm name, NE NE SW 20-4n-5w, Madison County; Browning et al 1 Hayton, NW NW SE 32-9s-1e, Williamson County.

Two Franklin County wildcats, Deep Rock Oil Co. 1 J. M. Kirk, NE SE SE 15-7s-4e, and Central Pipe Line Co. 1 Rose, SE NE SE 4-5s-3e, each about 2 miles from production, were testing good showings in Aux Vaux sand and McClosky lime, respectively.

ILLINOIS WILDCAT COMPLETIONS

Clark County: Grant Gallatin 1 F. Cole, SW SW SW 2-10n-13w, dry at 752 ft., Tar Springs sand top 752 ft.

Cumberland County: A. S. Keating 1 E. M. Gibson, NW SW NE 9-10n-7e, dry

DAILY AVERAGE PRODUCTION FOR WEEK

	Oct. 28 crude oil	November Distillate, allied products	November PAW quota all oils	Oct. 21 crude oil
Arkansas	80,800	5,100	83,100	80,650
California	883,250	52,400	937,400	892,450
Colorado	9,200	.....	9,000	9,300
Eastern	68,100	8,200	80,200	68,500
Illinois	200,900	12,200	212,200	190,700
Indiana	13,100	.....	13,000	12,600
Kansas	286,900	6,000	280,000	295,650
Kentucky	28,900	2,800	28,800	28,600
Louisiana	363,050	35,000	385,000	362,600
North Louisiana	73,300	.....	.....	72,850
South Louisiana	289,750	.....	.....	289,750
Michigan	48,200	500	51,000	44,300
Mississippi	49,050	.....	50,000	52,700
Montana	24,250	400	24,400	24,000
Nebraska	950	.....	1,000	950
New Mexico	104,750	5,500	115,500	104,700
Oklahoma	347,350	26,900	371,900	343,350
Texas	2,133,350	145,000	2,278,000	2,133,350
East Texas	371,300	.....	.....	371,350
East Central Texas	149,450	.....	.....	149,500
North Central Texas	148,800	.....	.....	148,800
Texas Panhandle	98,850	.....	.....	98,800
West Texas	492,900	.....	.....	492,800
South Central (S. A.)	19,700	.....	.....	19,750
South Texas (Laredo)	77,850	.....	.....	77,800
Lower Gulf Coast	236,900	.....	.....	236,850
Upper Gulf Coast	537,600	.....	.....	537,700
Wyoming	95,700	3,400	103,400	95,600
Total United States	4,737,800	303,400	5,023,900	4,740,000
Change from previous week	down 2,200	.....	.....	.....
Total production January 1-October 28, 1944				1,370,815,400 bbl.
Same period last year				1,221,012,200 bbl.

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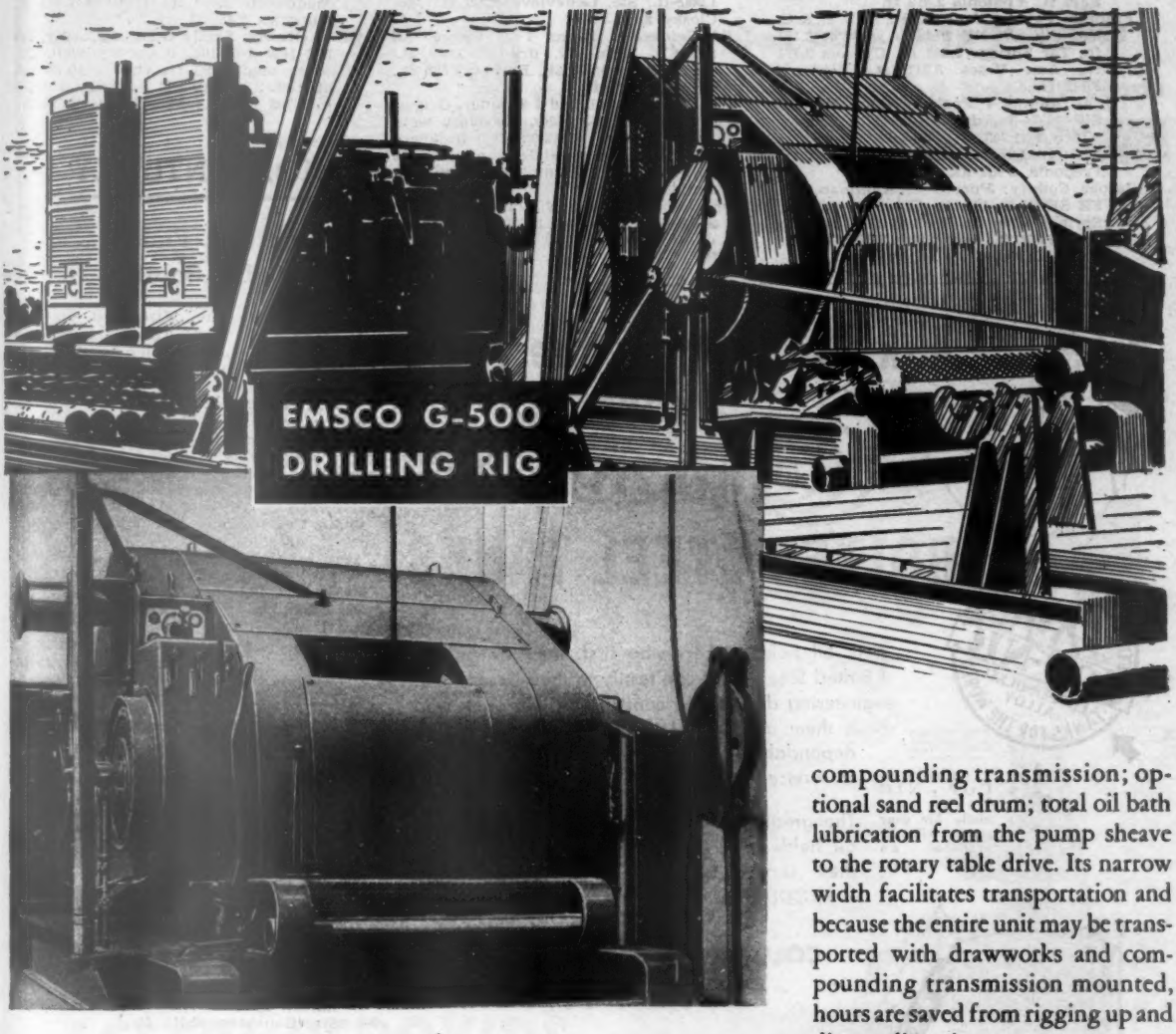

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at 2,258 ft., Tar Springs 1,744 ft., Weiler 1,951 ft., Aux Vases 2,094 ft., Fredonia 2,211 ft., no McClosky lime.

Effingham County: Frank Mitchell 1 C. Ruhill, SE SE SW 36-9n-6e, dry at 2,561 ft., Glen Dean 1,989 ft., Cypress 2,146 ft., Benoist 2,246 ft., Aux Vases 2,340 ft., Fredonia 2,512 ft.

Franklin County: Aetna Oil 2 U. S. C. & C. Co., SW SW NE 29-6s-4e, dry at 3,177 ft., Tar Springs 2,363 ft., Cypress 2,771 ft., Aux Vases 3,011 ft., Fredonia 3,142 ft.

E. S. Adkins 1 Peabody Coal, NE NE SW 14-7s-3e, dry at 3,047 ft., upper Kincaid 1,733 ft., Cypress 2,605 ft., Bethel 2,801 ft., Aux Vases 2,826 ft., Fredonia 2,937 ft.

Jasper County: Pure 1 C. Kaufman, NE SE SE 27-6n-10e, dry at 2,905 ft., Tar Springs 2,206 ft., Weiler 2,474 ft., Benoist 2,654 ft., Aux Vases 2,722 ft., Fredonia 2,828 ft.

Jefferson County: Magnolia 1 Szramkowski, NW NW SE 15-3s-1e, dry at 2,459 ft., Vienna 1,558 ft., Cypress 1,939 ft., Aux Vases 2,160 ft., McClosky 2,292 ft.

Lawrence County: Clark Nye 1 W. C. Tracy, NW NW NE 4-2n-12w, dry at 2,212 ft., Glen Dean 1,710 ft., Cypress 1,900 ft., Ste. Genevieve 2,130 ft., McClosky 2,134 ft.

Ed Geick and Aetna 1 J. Pierce, SE SE SW 31-3n-12w, dry at 2,069 ft., Tar Springs 1,708 ft., Barlow 1,886 ft., Benoist 2,047 ft.

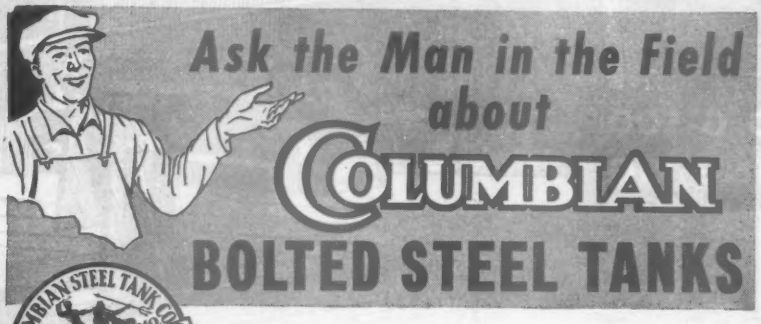
Big Four and Ashland 1 Sumner, Griggs, SW NE NE 13-3n-13w, discovery well, lower O'Hara 2,022-33 ft., Rosiclare 2,038-42 ft., both acidized, pumped 22 bbl. of oil in 24 hours from both formations.

Perry County: James N. Harah, NW NW SE 23-4s-1w, dry at 1,276½ ft., Vienna 781 ft., Cypress 1,111 ft., Benoist 1,262 ft.

Richland County: Pure 1 Gray, SE SW SE 9-4n-9e, dry at 3,195 ft., Tar Springs 2,425 ft., Weiler 2,715 ft., Aux Vases 2,984 ft., McClosky 3,079 ft.

St. Clair County: Sinclair-Wyoming 1 B. D. Baer, SW NW NW 23-2n-6w, dry at 2,575 ft., Ste. Genevieve 850 ft., Maquoketa 2,310 ft., Trenton 2,443 ft., Kinswick 2,459 ft.

White County: Skelly Oil 1 McCarthy, NE NE NW 7-6s-10e, discovery well, Cypress sand 2,705 ft., shot with 20 qt. at 2,696-2,703 ft., TD 3,173 ft., but PB to 2,705 ft., pumped 17 bbl. in 24 hr.



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TANKS FOR THE WORLD

OHIO, KENTUCKY

Summit Gas Field Extended to South

COLUMBUS.—The Wiser Oil Co. extended its Bath Township, Summit County, gas pool a location to the south by a 942,000 cu. ft. Oriskany well on J. C. Hostetler fee, Lot 44. Top of the sand was 1,956 ft. and drilling stopped still in sand, at 2,030 ft.

H. A. Dempsey found oil in the Newburg sand while drilling a test on H. S. Botzow farm, Lot 7, Hinckley Township, 1 mile north of the Hinckley pool. Sand at 3,050-3,126 ft. and at 3,215-18 ft. was acidized and produced 20 bbl. with 270,000 cu. ft. of gas.

Preston Oil Co. completed 1 Wilbur Midkiff, Section 3, Bedford Township, Meigs County. Berea sand at 1,603-17 ft. was shot and made 20 bbl. and 204,000 cu. ft. gas.

OHIO WILDCAT COMPLETION

Holmes County, Mechanic Township: Large et al 1 Roy E. Conrad, Lot 6, Clinton 3,612-89 ft., dry, TD 3,789 ft.

WESTERN KENTUCKY

OWENSBORO, Ky.—A 920-bbl. initial producer was the best of six oil wells reported completed in Western Kentucky in the past week. It was Carter Oil Co. 12 Watt Clements, in the Uniontown pool, Union County, producing from Cypress sand at 2,266-74 ft. In the same pool E. J. Ruwaldt 1 fee produced 400 bbl. of oil and 125 bbl. of water from Tar Springs sand at 1,844-64 ft.

WESTERN KENTUCKY WILDCAT COMPLETION

Henderson County: R. O. Gould 1 J. Pierce, 9-P-22, dry at 2,645 ft. Upper Menard 1,652 ft., Glen Dean 1,907 ft., Barlow 2,173 ft., Renault lime 2,393 ft., Ste. Genevieve 2,511 ft.

EASTERN KENTUCKY

ASHLAND.—Two gas wells were completed in Eastern Kentucky this week with operations moving on the same level as reported throughout the month. One dry well was included in the report from this area.

Kentucky West Virginia Gas Co. has completed well 441 on the R. L. Conley tract on Mat's Branch of Jones Fork in Knott County at a total depth of 2,700 ft. in shale with a daily open flow of 163,000 cu. ft. of gas.

The same company reports the completion of well 5,556 on the C. W. Preece land on Wolf Fork in Martin County at a total depth of 1,690 ft. with a daily open flow of 353,000 cu. ft. of gas.

Cardinal Oil Co. hit a dry hole in well 5 on the Harris heirs tract on Station Camp Creek in Lee County close to the Lee-Estill line. The well had a total depth of 775 ft.

INDIANA

EVANSVILLE, Ind.—Three oil wells in old fields and five dry holes, also in established fields, were recorded in the week in review in Indiana. No wildcat completions were reported.

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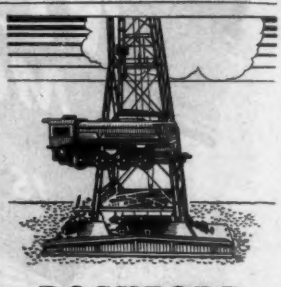

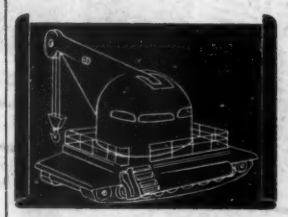

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SOUTH LOUISIANA

Gas-Condensate Discovery Completed in Acadia

NEW ORLEANS. — Phillips Petroleum Co. 1 Onezime, 16-10s-1e, gas-condensate discovery well in Crowley area, Acadia Parish, flowed 33 bbl. a day on 11/64-in. choke, for completion in perforations 9,738-41 ft. Total depth is 10,000 ft.

Amerada Petroleum Co. 1 J. G. Daigle et al "F" unit, at South Lewisburg field, Acadia Parish, flowed potential of 40 bbl. condensate daily on ⅛-in. choke from perforations 10,214-10,262 ft. Total depth 10,600 ft.

Shell Oil Co., Inc., 3 C. S. Baldwin, at Bear field in Beauregard Parish, set 9⅝-in. surface pipe with total depth 1,332 ft. and is drilling ahead. This is first activity for this field in several months.

Humble Oil & Refining Co. 2-B Petit Anse Co., Inc., Avery Island field, in Iberia Parish, which topped salt above 9,629 ft., set 7-in. casing to 9,575 ft., and is drilling ahead at 10,637 ft. still in salt, in an attempt to go through the salt section.

Gulf Oil Corp. 10 Delta Securities Co., Bully Camp field, La Fourche Parish, is completed as a gas well in perforations 6,516-30 ft., total depth 6,984 ft., 5½-in. set at 6,840 ft. No gage of the gas was made and the well is shut in with shut-in tubing pressure 2,600 lb. It showed tubing pressure 2,500 lb. while flowing on ⅛-in. choke.

Sun Oil Co. and Tide Water Associated Oil Co. 1 Burleigh-Miller pool, at Shuteston field, St. Landry Parish, made potential of 155 bbl. a day on ⅛-in. choke from perforations at 9,496-9,501 ft. Total depth 10,365 ft.

Sun Oil Co. 1 E. Domongeaux, at Cankton field, St. Landry Parish, flowed potential of 260 bbl. per day on 8/64-in. choke from perforations 9,610-26 ft. Total depth 10,501 ft.

SOUTH LOUISIANA WILDCAT COMPLETIONS

Rapides Parish: Claude Morgan 1 Irene Wettermark, 24-5n-3w, dry at 7,001 ft.

Treatment of Mud for Deep Drilling
In Keystone Area of West Texas
by Joseph C. Gordon
NEW SIW
MUD SCREEN
IS MAKING NEWS
Engineering and Operating
Reproduction of article appearing in
OIL AND GAS JOURNAL, June 24, 1944

Operators in this area are using the SIW Mud Screen to help overcome the slow and costly drilling conditions caused by the hard lime and chert formations, which in some instances wear out bits every ten feet. As reported in this article, the SIW Mud Screen is accomplishing some highly satisfactory results. The SIW Mud Screen has been designed by engineers who know what is required of a mud screen. Ask for complete details if you want better shale removal from your drilling mud.

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TEXAS GULF COAST

New Field in Making In Hardin County

HOUSTON. — A new field for Hardin County is in the making at Houston Oil Co. of Texas and American Republics Corp. 1 Hardin County School Land-fee, which is cleaning gas and wash water on ½-in. choke from perforations at 5,796-5,807 ft., showing tubing pressure 1,800 lb., casing pressure 800 lb. Total depth is 7,006 ft. with 5½-in. casing set at 5,880 ft. This test had recovered gas condensate with some fresh water on drill-stem test at 5,799-5,808 ft. while the hole was being drilled. This wildcat is in northern part of the county, Hardin County School Land Survey, about 5 miles south of Warren.

Sun Oil Co. 1 Merchant estate, deep test in the Sour Lake area of Hardin County, is drilling 8,329 ft. in hard sandy shale.

Skelly Oil Co. 1 Granbury-Fullilove unit, wildcat about 3 miles northeast of Van Vleck in Matagorda County, recovered gas on test in perforations at 8,760-64 ft. Total depth is 10,010 ft. The 7-in. casing was set to 8,862 ft. but was found to be bad, so a string of 5½-in. is cemented at 8,854 ft.

Pan American Production Co. 1 L. E. Posey, in John B. Richards Survey, Montgomery County, picked up sand with oil odor 8,812-20 ft. in cores, ran 23-minute drill-stem test and recovered 29 stands of salt water. It is now drilling ahead.

Humble Oil & Refining Co. 20 Grandbury et al, new Wilcox producer at Livingston field, Polk County, flowed Railroad Commission potential of 108.24 bbl. per day on ¼-in. choke, gas oil ratio 346 to 1, from 54 perforations at 7,014-32 ft., tubing pressure 110 bl., casing pressure 1,100 lb., gravity 36.8°, 0.5 per cent water. Sand was topped at 7,014 ft. Total depth is 7,080 ft., plugged-back total depth 7,037, with 2-in. casing set at 6,980 ft.

General Crude Oil Co. 2 Security Bank & Trust Co., wildcat 4 miles southwest of Lane City in Wharton County, tested salt water in 12 perforations at 5,540-43 ft., squeezed and is preparing to reperforate for a test in another sand. Total depth is 5,727 ft., 5½-in. casing set to 5,550 ft.

Salt Dome Oil Corp. et al 1 Joe Vitera, 3 miles northwest of Louise in Wharton County, is completed as a gas well and shut in, no gage, from perforations at 4,780-4,816 ft. Total depth is 5,591 ft., with 5½-in. casing set for completion.

The nomenclature committee of the South Texas Geological Society has given the name "Hope" to the field discovered by Sterling Oil & Refining Corp. at 1 M. Hoffman in D. B. Oakes Survey, Lavaca County.

TEXAS UPPER GULF COAST WILDCAT COMPLETIONS

Colorado County: Superior Oil Co. of California 1 Matilda Tait, BBB&C Sur., 2 mi. NW of Altair, dry at 10,350 ft.

Matagorda County: The Texas Co. 3 C. G. Hamill, Wm. Baxter Sur., 9 mi. S of Sargent, originally temporarily aban-

doned at TD 7,500 ft. in February 1944, resumed in June 1944, and drilled to 7,950 ft., PB and sidetracked at 7,250 ft., drilled to TD 12,512 ft., dry.

MICHIGAN

Deep River Test A Big Producer

SAGINAW.—Arenac County's Deep River field and the new Bloomer pool in Montcalm County contributed most of the initial new potential of 5,300 bbl. a day to Michigan oil production in the past week. Basin Oil Co.-Don Rayburn 1 Borushko in Section 3 of Deep River came in at 150 bbl. an hour and the Wadsworth-McClure 1 Bogert, Section 32 of Bloomer, flowed 40 bbl. an hour. Four other producers, one in Allegan's Fillmore Township field, one in Hampton of Bay, one in Wise-Isabella, the other in Chippewa of Mecosta produced at from 140 to 312 bbl. a day. There were three gas wells and eight dry holes among the 17 completions, including a Pure Oil Co. deepening test in Section 33 of Sherman Township, Isabella County, for exploration of deeper formations in the area. The test ended unsuccessfully at 4,994 ft. Completions were scattered over a dozen counties.

Allegan County received five of the 22 drilling permits issued for the week by the state Conservation Department. Montcalm and Mecosta got three each, Bay and Isabella two each, and the remainder going to Arenac, Cass, Clare, Kent, Otaawa, Missaukee and Van Buren counties.

MICHIGAN WILDCAT COMPLETIONS

Ionia County, North Plains Township: C. L. Maguire, Inc., 1 St. Clair, C S½ NW SE 28-8n-5w, dry in Dundee, TD 3,033 ft.

Mecosta County, Colfax Township: Chapman Oil Co. 1 Herbert Tetzlaff, C S½ NW SW 4-15n-9w, dry in Monroe, TD 3,672 ft.

Martiny Township: Michigan Consolidated Gas Co. 1 State, NW SE NW 13-15n-8w, dry, TD 1,436 ft.

Sanilac County, Fremont Township: Swan-King Oil Co. 1 George Marshall, SE NE NW 29-9n-15e, dry, TD 2,502 ft.

APPALACHIAN FIELD

Fair Well Completed In Kanawha County

PITTSBURGH.—In West Virginia, Virginian Gasoline & Oil Co. completed a fair oil well on Imperial Coal Co. 1,355 in Cabin Creek district, Kanawha County, which is showing for 50 bbl. a day from the Berea sand at total depth 3,270 ft. This is a northeast extension of an old Berea pool. A second well is now drilling to test the extension.

In Ravenswood district, Jackson County, United Carbon Co. in a test, No. 1,199 J. C. Fisher, struck a volume of 933,000 cu. ft. gas in the Salt sand at 1,594-97 ft. with a rock pressure of 460 lb. in 40 minutes. Casing was run to the top of the gas and the gas is being tested.

In Butler County, southwest Pennsylvania, the test of Manufacturers Light & Heat Co. on J. G. Hockenberry farm in Mercer Township, is drilling at 9,912 ft., a cable-tool record for the east. The present formation appears dolomitic with some sand of varying degree giving evidence of being in the Beekmantown, Ordovician,

CALIFORNIA

Standard's Deep Test Reaches 15,542 Ft.

LOS ANGELES.—Late this week Standard Oil Co. of California's deep well in the South Coles Levee field had reached a depth of 15,542 ft. and was still drilling ahead. This deep well in addition to giving Standard valuable geological information should definitely set at rest any claims that the Elk Hills Naval Reserve extends over into North and South Coles Levee as it indicates a definite break between the fields in question. This well is already 4,000 ft. below the depth at which the Stevens of Miocene age was encountered at Elk Hills. The present objective is the Vedder of lower Miocene age.

H. H. Magee's test in the Trico district of Kern County has drilled out after landing 7-in. casing in 2 Amalgamated Happold and is testing for water shutoff. This wildcat is reported to have picked up both the upper and lower Vedder of Miocene age at some point above the bottom of the hole at about 10,390 ft.

Shell Oil Co., Inc., appears to have discovered a new field southeast of production in the Oak Canyon field as 88-4 Claiborne in 4-4n-17w topped oil sand at 3,900 ft. On a 1-hour formation test at 3,900-4,015 ft. the recovery was 10 stands of oil and oily mud. A string of 7-in. has been cemented at 3,900 ft. and preparations are under way for an early production test. This outpost was drilled to 6,010 ft. and the hole redrilled from 3,700 ft.

These tools are intended for fishing where the clearance is close between the fish and the well bore. They frequently save a pin milling job but, obviously, they have limited strength. However, when made to the Spang Higher Standard of tough steel with thorough heat-treatment, they will do more than one might expect.

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to 4,015 ft. It is located on the Hasley Canyon anticline and the potentially productive limit is probably the equivalent of the upper sand found in the Oak Canyon field by Western Gulf a few years ago.

Superior Oil Co. has suspended work on 38-35 Houghton in 35-29s-26e at 9,055 ft. and Standard Oil Co. of California has reached a depth of 10,940 ft. in 61-2 Brittain-trustee. Southeast of production in the field, Western Gulf Oil Co.'s 77-5 Kern County Land in 5-30s-27e was dry at 12,222 ft. Top of the Rio Bravo was cored in this well at 11,923 ft. and top of the Vedder of Miocene age was found at 11,957 ft. Both zones were barren.

At Mountain View, where Tide Water Associated Oil Co. found a new accumulation north of the old field, development work has shown an increase during the past few weeks with five strings of tools in operation. At Elk Hills, 10 wells are being rigged for pumps indicating an early completion. Development work has been running slightly behind the schedule outlined for the field several months ago.

CALIFORNIA WILDCAT COMPLETIONS

Bellevue outpost well, Kern County: Western Gulf 77-5 Kern County Land, 5-30s-27e, dry in hard gray sand, base Macoma 4,921 ft., Valvulineria 10,041 ft., Rio Bravo 11,923 ft., Vedder 11,957 ft., TD 12,222 ft.

Fruitvale outpost well, Kern County: General Petroleum 76-29 Kern County Land, 29-29s-27e, in hard gray sand, base Etchegoin 4,035 ft., no showings, TD 6,610 ft., dry.

Round Mountain outpost well, Kern County: Tide Water Associated 1-27 Olcese, 27-28s-29e, dry in hard gray Miocene sand, Vedder sand of Miocene age 3,140 ft., barren, TD 3,170 ft.

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PERMIAN BASIN

Two Discoveries Likely For Southwestern Gaines

MIDLAND.—Southwestern Gaines County attracted considerable attention last week as Humble Oil & Refining 1 Doss flowed 8 bbl. oil per hour from Lower Permian pay, and Shell Oil Co., Inc. 1 Sparks, 7 miles east of the Humble test, indicated a new pool at 10,000 ft., possibly in the Ellenburger. Humble 1 Doss, testing through perforations at 7,030-80 ft., opposite the Fullerton zone, used 1,000 gal. of acid and responded flowing 8 bbl. of oil per hour through ½-in. choke. Shell 1 Sparks, in Section 3, Block A-13, recovered 4,700 ft. of oil and gas-cut mud on a drill-stem test from 9,980-10,035 ft., although packer failed after tool was open for 3 minutes. Following the test it drilled ahead to 10,045 ft. and prepared to make another drill-stem test.

New wildcats announced during the week included Humble 1 E. M. Jones, NW NE Section 17, Block A-40, western Andrews County, to go to 8,500 ft. It is 1¼ miles south of a 10,929-ft. dry hole drilled by the same company and about 5½ miles southeast of Gulf Oil Corp. 1 Drinkard, a new Lower Permian lime discovery in Lea County, New Mexico. In Ector County Shell Oil Co., Inc. 1 Thomas estate was located in NW NW Section 8, Block 45, T-1-S, T&PRR Survey, nearly a mile northeast of the Shell-Cities Service 1 TXL, which was drilling past 9,497 ft., apparently in the Simpson formation, with good production already assured from both the Devonian and the Silurian lime sections. Rowan Drilling Co. of Fort Worth also has entered the deep play in this area, staking its 1 TXL in NW SE Section 29, Block 45, T-1-S, T&PRR Survey, being approximately 2½ miles south and slightly east of the Shell-Cities Service discovery well.

Lion Oil Refining Co. 1-B University, wildcat 3 miles west of Pyote, Ward County, was completed flowing 122 bbl. of 34.6-gravity oil daily through 24/64-in. choke from Delaware sand and lime between 4,979-94 ft., to open a new Delaware sand field on the west side of the Permian basin.

The rough Davis Mountain country to the west of the Permian Basin chalked up another failure as Humble Oil & Refining Co. 1-B Reynolds Cattle Co. was abandoned at total depth 5,417 ft., short of its projected 8,000-ft. goal. Located 10 miles northeast of Plateau, Culberson County, and spudded nearly 1½ years ago, it encountered almost continuous trouble with cavings and cavities.

Gulf Oil Corp. is starting a 10,000-ft. Ordovician wildcat, 3-B-E John Edwards et al in the NE NE Section 11, Block B-18, northwestern Crane County. It is 3½ miles northwest of Gulf 6-E McKnight, another deep wildcat which was drilling past 7,131 ft. after testing a show of oil and salt water in the Simpson at 6,072-7,100 ft.

WEST TEXAS WILDCAT COMPLETIONS

Andrews County: Stanolind 1-J Midland Farms, Sec. 32, Blk. 41, G&MMB&A Sur., 12½ mi. SE Andrews, elev. 3,205 ft., Yates 3,090 ft., Grayburg 4,550 ft., dry, TD 4,876 ft.

Gaines County: The Texas Co. 1 J. L. Brown, League 311, subd. 8, Gaines CSL, 15 mi. SE Seminole, elev. 3,147 ft., dry, TD 5,650 ft.

Howard County: Brown & Karcher 1-A J. C. Caldwell, Sec. 32, Blk. 32, T-3N, T&P Sur., elev. 3,585 ft., dry, TD 2,251 ft.

Duncan Drilling Co. 1 Mrs. Battle Motley, Sec. 19, Blk. 30, T&P Sur., 4 mi. SE Coahoma, elev. 2,389 ft., dry, TD 3,012 ft.

Pecos County: Humble Oil & Refining Co

FOR toughness, elephant hide and Pittsburgh Tankhide are two of a kind. When this rugged finish goes on your oil and gasoline storage tanks, you can be sure of getting the best protection modern science can devise. Tankhide provides a tough, durable "hide"—highly resistant to corrosion and the weather.

Extremes of heat and cold mean nothing in Tankhide's long life. It is enriched with *"Vitolized Oils"* which keep the paint film *live,* tough and elastic long after application. Thanks to Tankhide's ability to expand and contract, the ups and downs of the thermometer have little effect on Tankhide.

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Expert advisory service is offered to users of Pittsburgh Industrial Finishes. Our extensive experience in the field can often save you time and money.

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PITTSBURGH *Industrial* **FINISHES**

PITTSBURGH STANDS FOR QUALITY PAINT AND GLASS

1 Dow Puckett, Sec. 150, Blk. 3, T&P Sur., 11 mi. SW Fort Stockton, elev. 2,402 ft., dry, TD 3,225 ft.

Winkler County: Tide Water 1 C. O. Wheeler, Sec. 12, Blk. B-7, PSL, elev. 3,102 ft., Devonian 8,350 ft., tentative Simpson 9,560 ft., Ellenburger 10,535 ft., flowed natural 1,474 bbl. day through ½-in. choke on tubing, gas-oil ratio 1,085 to 1, gravity 45.6, TD 10,680 ft.

SOUTHEAST NEW MEXICO

HOBBS.—Gulf Oil Corp. 1 Drinkard, new and deeper pay eastern Lea County discovery, flowed 782 bbl. of pipe-line oil in 14 hours after using 3,000 gal. of acid on the Permian Clear Fork lime pay section at 6,370-6,430 ft., producing through ¾-in. tubing choke, with 775 lb. flowing pressure. Located in 30-22-38, and about 2 miles east of the shallower Permian lime and sand producing areas designated as the Penrose-Hardy fields, producing from 3,600-3,700 ft., Gulf's new discovery is generally regarded as the opener of a major field in the Permian basin. In southeastern Lea County, Humble Oil & Refining Co. 1 Federal-Leonard Oil Co., deep Ellenburger discovery, was swabbing in after perforating pipe at 11,890-928 ft.

Hopes of Ordovician production in Continental Oil Co. 2-B-23 Skaggs vanished when it topped granite at 10,430 ft. and halted at 10,455 ft. to measure. It reported no shows in the Simpson formation, topped at 9,775 ft., and logged no Ellenburger before striking granite. Some shows higher up the hole may be tested.

SOUTHEASTERN NEW MEXICO WILDCAT COMPLETION

Lea County: Tide Water Associated Oil Co. 1-N State, 19-22s-35e, 4 mi. SW San Simon field, elev. 3,557 ft., dry, TD 4,500 ft.

TEXAS PANHANDLE

AMARILLO.—Humble Oil & Refining Co. 1 Pronger Bros., scheduled 9,000-ft. wildcat in Sherman County, cemented 9⅝-in. casing at 2,850 ft. with total depth 3,156 ft. in lime, where it lost returns and was preparing to test to determine if it was in a gas zone. In same county, Keriyn Oil Co. 1 Sealy estate was plugging back from total depth 5,000 ft. to test gas, previously estimated at 4,500,000 cu. ft. daily, between 2,850-3,117 ft.

Two Murphy Diesel Engines, equipped with clutch, power take-off, on a typical oil field application where Murphy Diesels replaced original equipment.

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ROCKY MOUNTAIN

Big Sand Draw Discovery Improves With Deepening

DENVER. — The Tensleep test of the Sinclair-Wyoming Oil Co. on the Big Sand Draw structure, Fremont County, Wyoming, continues to look favorable for a major discovery as drilling continues toward the objective. The well, 1 Unit, SW NW NW 14-32n-95w, last week showed for a discovery in the drill-stem test at 6,896-6,913 ft. in the upper Embar. Open 57 minutes, it made 1,560 ft. of 32.5° gravity oil, 633 ft. of oil-cut mud and 90,000 cu. ft. of gas. It was then deepened and a second test of the lower part of the section was made at 6,930-55½ ft. Open for 17 minutes, it showed 15,000.000 cu. ft. of gas and 20 gal. of 54°-gravity distillate. It is drilling ahead at 6,974 ft. with the Tensleep as the next objective. In the second drill-stem test the estimated gas-oil ratio was 375.000 cu. ft. The shut-in pressure was 3,350 p.s.i. The ground elevation is 6,142 ft., and principal tops are as follows: Frontier, 2,952 ft.; Dakota, 4,460; Lakota, 4,524; Nugget, 5.163; Chugwater, 5,475 ft.; Alcova lime, 5,842; Embar shale, 6,896; Embar lime, 6,933 ft.

North Big Hollow discovery.—A discovery in the Muddy sand is reported in the North Big Hollow district, Albany County, Wyoming, in Oklahoma Oil Co. 1 Union Pacific-Fuller, C NE NW 7-15n-75w. The sand was found at 827-848 ft. and on a drill-stem test it indicated an initial production of around 65 bbl. per day. It was then given a swabbing test and made 6 bbl. per hour until a 100-bbl. tank, the only storage at the site, was filled. The 5½-in. was set at 827 ft. No water was encounetred. The oil is approximately 22° gravity.

Belle Springs gas discovery. — Rocky Mountain Gas Co. 1 Johnston, C NE SW 6-23n-88w, Belle Springs structure, Carbon County, Wyoming, was drilled to 3,852 ft. and then plugged back to 2,600 ft. and completed in the Sundance sand for 4,000,000 cu. ft. of gas per day. The structure is 10 miles south of the Mahoney field.

Oil show at Crook's Gap.—Sinclair-Wyoming Oil Co. 1 State, NW SW NW 18-28n-92w, a test to the Tensleep, topped the Muddy sand at 5,055 ft. and is bottomed at 5,097 ft. Five feet of saturated core were recovered at 5,063-69 ft., and preparations are being made for a drill-stem test.

COLORADO WILDCAT COMPLETIONS

Archuleta County, Pagosa Springs: L. R. Travis 1 Federal, NE NW NW 35-36n-1w, TD 2,035 ft., water in Dakota, dry.

MONTANA WILDCAT COMPLETIONS

Liberty County, Prescott Block: Texas 1 Baabe, NW SE SE 19-34n-6e, TD 3,200 ft., top of Madison 2,916 ft., 7-in. 3,197 ft., perf. 160 shots at 2,993-3,022 ft., acid. 2,000 gal., 2,933-3,022 ft., dry.

WYOMING WILDCAT COMPLETIONS

Carbon County, Belle Springs: Rocky Mountain Gas 1 Johnston, NE SW 6-23-88w, TD 3.852 ft., PB 2,600 ft. and completed in Sundance for 4,000,000 cu. ft. of gas.

Albany County, North Big Hollow: Okla-

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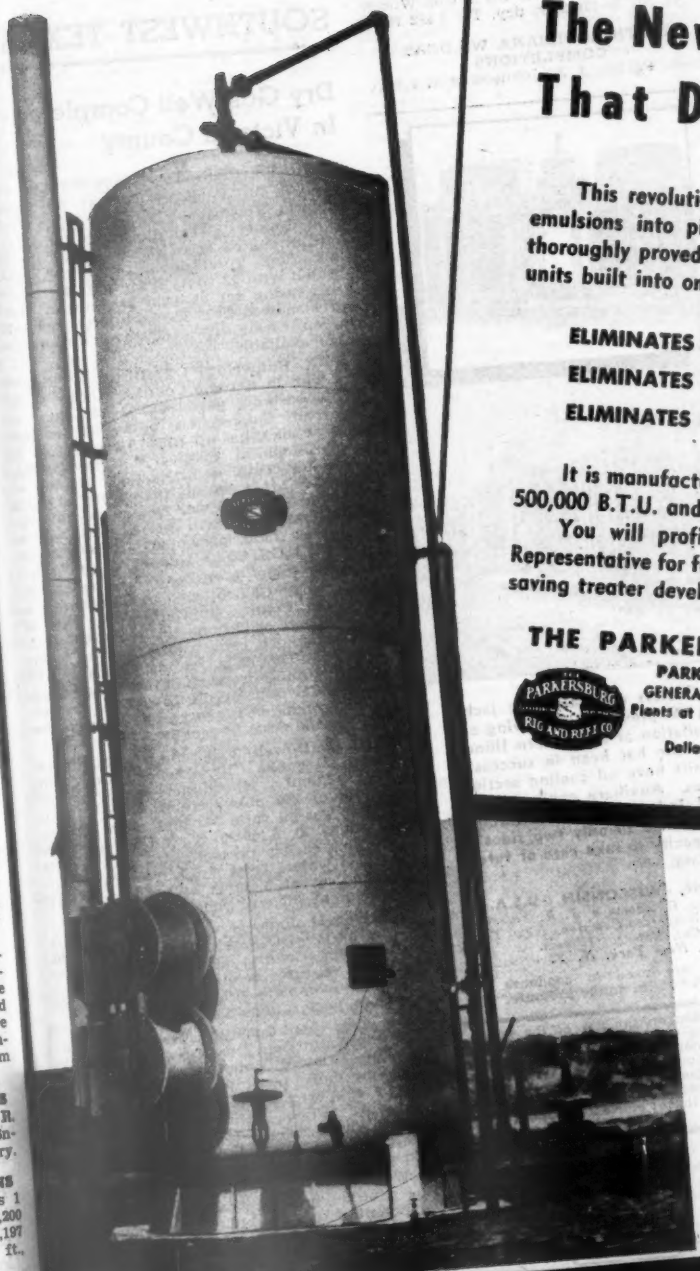


PARKERSBURG

homa Oil 1 Union Pacific-Fuller, NE NW 7-15n-75w, completed in Muddy at 827-848 ft., swabbed average 6 bbl. per hour, est. 65 bbl. per day, 22° gravity oil.

LA.-ARK.

Condensate Fields Show Pressure Drops

MAGNOLIA.—Data presented by their engineers to the Arkansas Oil and Gas Commission this week showed that the reservoir pressure in several condensate fields had dropped since the last pressure survey. Daily average pressure drops in pounds per square inch were: Dorcheat, 1.00 lb.; Atlanta, 0.75 lb.; Macedonia, 0.74 lb., Calhoun (new field), 0.33 lb.; Atlanta West, 0.32 lb.; Magnolia, 0.27 lb.; Schuler-Jones, 0.15 lb., while Midway showed a slight gain of 0.01 lb.

Establishment of field rules for the Calhoun field in Columbia County and the Salem Church field in Union County was delayed, awaiting further development. The salt water disposal system for the Magnolia field was reported starting, with one disposal well about complete and ready for testing.

ARKANSAS WILDCAT COMPLETIONS

Chicot County: Placid Oil 1 Cox-Wilson, SE SE 34-17s-22w, dry, TD 4,492 ft.

NORTH LOUISIANA WILDCAT COMPLETIONS

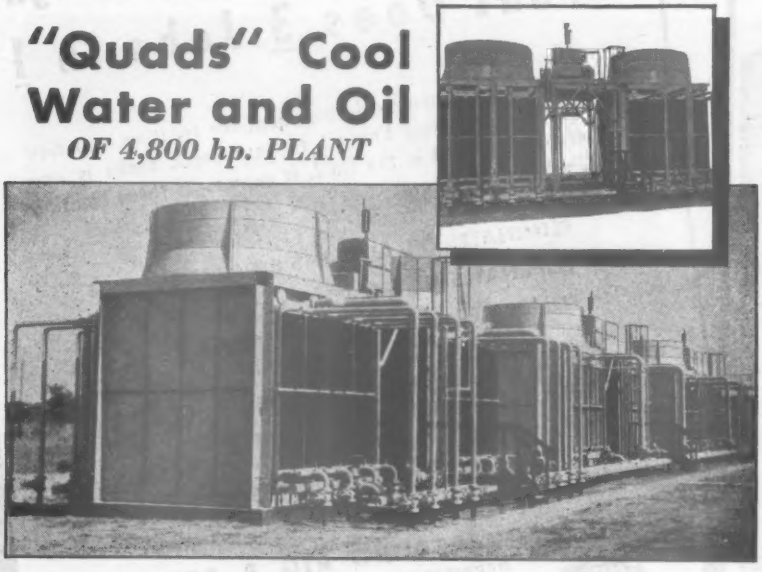
DeSoto Parish: J. A. Johnson et al 1 Guy, 1,650 ft. S and W of NE cor. 3-11n-13w, 15 bbl. oil from pay zone 2,728-38 ft., TD 2,738 ft., basal Eagleford 2,728 ft.

Webster Parish: Carter 1 Davis, NE NE 33-18n-8w, 12,500,000 cu. ft. gas from pay zone 5,465-5,520 ft., TD 7,600 ft., Rodessa 5,465 ft.

MISSISSIPPI WILDCAT COMPLETIONS

Jasper County: Sinclair-Wyoming 1 Clayton, SW NE 1-1n-12e, dry, TD 6,832 ft., Massive 6,616 ft.

"Quads" Cool Water and Oil OF 4,800 hp. PLANT



★ The above battery of Young-Happy "Quad" Coolers maintains the jacket water and lubricating oil of eight 600 hp. v-angle compressors and driving engines at suitable operating temperatures. This installation at a Southern Illinois refinery* for the production of Iso-Butane and Butane has been in successful operation for more than a year. Four of the six units have oil cooling sections mounted in front of the jacket water cooling cores. Auxiliary engines (each serving two units) rotate 10 ft., especially designed, induced draft fans through right angle speed reducers. At present, cores are installed in only two sides of each "Quad", leaving room for increased cooling capacity to take care of future plant expansion. Write for complete engineering data.

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*Three "Quad" Condensers are used to condense 40,000 lbs. of steam per hour at 10 lb. gauge pressure.

Young "Quad" Coolers and Condensers function on the same principle as automotive radiators—there are no water losses or external pumping heads. Where temperatures below the ambient dry bulb are required Young evaporative type units (left) may be used independently or supplementary to "Quads". Minimum operating costs and water make-up requirements are assured with these efficient evaporative coolers and condensers.

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SOUTHWEST TEXAS

Dry Gas Well Completed In Victoria County

CORPUS CHRISTI.—Kingwood Oil Co. 1-A M. F. Bass, wildcat northwest Victoria Townsite 4 League grant, Victoria County, is completed as a dry gas well, estimated 20,000,000 cu. ft. per day on open flow. Total depth is 4,957 ft., perforated with 12 shots from 4,887-89 ft. and 7-in. casing set at 4,957 ft. Shut-in pressures showed 2.825 lb. on tubing and 2,975 lb. on casing. It is shut in, no official gage available.

P. R. Rutherford 1 Smith-Crow, discovery well in Refugio County, 8 miles south of Woodsboro, gaged 82.50 bbl. daily on Railroad Commission potential through ½-in. choke, gas-oil ratio 9,268:1, from 24 perforations at 4,500-04 ft., gravity 24°, no water. Total depth is 6,505 ft., top of pay 4,485 ft., and 5½-in. casing at 5,578 ft. The South Texas Geological Society states this well will be carried in the Bennview field, previously discovered by Barnsdall Oil Co. 1 Neimann gas well.

Humble Oil & Refining Co. 1 A. M. Lockwood, Charlotte field extension in Atascosa County, flowed at the rate of 108 bbl. oil on 7-hour test through ¼-in. choke, 30 per cent water, net oil being 75.6 bbl., 110,000 cu. ft. gas, gas-oil ratio 1,400:1, tubing pressure 130 lb. Total depth is 6,919 ft., with 5½-in. casing set on bottom. Production is from the Edwards lime pay at the 6,900-ft. level.

H. H. Howell 2 Lorene J. Spoonts at North Magnolia City extension area, Jim Wells County, is completed flowing potential of 260 bbl. daily through 3/16-in. choke, gas-oil ratio 342 to 1, from 42 perforations at 5,409-20 ft., tubing pressure 625 lb., casing pressure 925 lb., gravity 31°, no water. Total depth 5,460 ft., 5½-in. casing set at 5,458 ft., 2-in. set at 5,411 ft. Top of oil pay reported 5,413 ft.

Edwin M. Jones is testing in the 6,900-ft. sand at the 4-C Ezzell, at San Caja field, McMullen County, through perforations 6,913-28 ft. after acidizing. Operator plans to dual complete this well at this level and in perforations 6,469-71 ft.

Plymouth Oil Co. 131-C Mrs. E. H. Welder, Plymouth field extension, San Patricio County, flowed potential of 128.42 bbl. net oil daily plus 19.12 per cent water from 10 perforations 5,556-60 ft., tubing pressure 525 lb., casing pressure 825 lb., gas-oil ratio 483 to 1, gravity 31.5. Total depth is 5,566 ft., with 5½-in. casing set on bottom.

W. L. Goldston 3-C Sugarland Industries, at Boyle field, Starr County, flowed a potential of 91.08 bbl. per day on 7/64-in. choke from 48 perforation at 3,945-54 ft. in sand topped at 3,942 ft. Tubing pressure 300 lb., casing pressure 900 lb., gravity 40°, no water. Total depth is 4,003 ft. with 5½-in. casing set at 3,974 ft.

The Nomenclature Committee of the South Texas Geological Society has officially named two new South Texas fields as follows: Oakville-Wilcox is the name

(Continued on page 149)

OKLAHOMA

Anadarko Basin Deep Tests to Start in 1944

THE deep test play in the Anadarko basin of western Oklahoma had a 1945 starting date in the minds of most observers, but this week Superior Oil Co. announced that contract had been let and work would be started immediately on Superior et al 1 Norris, NE NE 17-19n-10w, near O'Keene in northern Blaine County, to test Wilcox expected at around 9,000 ft. It is also reported that H. L. Hunt and associates may start a test in the SW 33-22n-14w, in Major County. Leasing activity in Blaine, Major and Dewey counties has been intense.

West Edmond.—The unexpected seems to be the rule in this field, and continued to prevail, as Cities Service Oil Co. 1 Gaffney, SE NE 29-15n-4w, which appeared to be a big gas well in the Bartlesville sand after missing the Hunton, flowed 349 bbl. of 63° gravity condensate in 20 hours, with 8,800,000 cu. ft. of gas, from the Bartlesville sand.

Pipe-line runs averaged 30,800 bbl. per day from 196 connected wells, an increase of 2,350 bbl. and 12 connections over last week. Week-end completions brought the total number of producing wells to 213.

Love County.—Sinclair-Prairie Oil Co. 1 Donaghey, NW SE NE 35-8s-2e, a wildcat test across the river from the Walnut Bend pool of Cooke County, Texas, drilled to a total depth of 6,430 ft. without finding anything. The Simpson at 5,492-5,534 ft. and the Arbuckle at 5,548-5,785 ft., both had salt water. The test is being plugged.

Sinclair-Prairie 1 Smith, NE SW NE 34-6s-2w, is drilling below 7,530 ft., with no shows reported. Stockton sand was identified at 7,151-72 ft. Magnolia Petroleum Co. 1 Williams, SW SE 6-6s-3w, is drilling below 4,000 ft.

OKLAHOMA WILDCAT COMPLETIONS

Cleveland County: Deep Rock et al 1 Harris, NE NW NE 11-10n-1w, pumped 58 bbl. from pay zone 5,930-40 ft., is an old well worked over, old TD 6,509 ft., TD 6,603 ft., paying from an unnamed sand.

Kay County: Bridgeport Oil 1 Branine, NE NE SE 14-29n-1w, dry, TD 3,726 ft., Wilcox 3,668 ft.

Lincoln County: R. L. Kemp et al 1 Long, SE NW 15-16n-5e, dry, TD 3,877 ft., Inola 3,730 ft.

Okfuskee County: Texas 1 Replogle, SW NW NE 33-12n-9e, dry, TD 3,406 ft., Pitkin lime 3,380 ft.

Northern Ordnance 1 Graham, NW NW NW 8-11n-11e, dry, TD 3,882 ft., Viola 3,810 ft.

Osage County: Peters & Norbla No. 2, SW SE NW 35-20n-11e, pumped 50 bbl. from pay zone 2,420-95 ft. after treatment with 1,500 gal. acid, TD 2,535 ft., Hominy 2,420 ft., Arbuckle 2,522 ft.

Payne County: Anderson-Prichard 1 Lafon, SW SW NW 5-19n-1w, dry, TD 5,247 ft., Wilcox 5,120 ft., second Wilcox 5,216 ft.

WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended October 28, 1944					Cumulative total, 1944				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	0	0	0	1	1	2	0	17	59	78
Indiana	0	0	0	0	0	4	0	0	20	24
Illinois	2	0	0	12	14	29	0	0	266	295
Kentucky	0	0	0	1	1	13	0	0	73	86
Michigan	0	0	0	4	4	12	0	3	201	216
Kansas	1	0	0	11	12	46	0	9	368	423
Neb., Mo., Iowa	0	0	0	0	0	1	0	0	14	15
Oklahoma	2	0	0	5	7	60	1	20	226	307
Texas:										
North Central	2	0	0	2	4	55	0	1	255	311
West	1	0	0	8	9	39	0	3	153	195
Panhandle	0	0	0	0	0	0	0	2	9	11
Eastern	0*	0	1	0	1	5	0	4	102	111
Gulf Coast	0	0	0	2	2	30	12	13	190	245
Southwest	1	0	1	4	6	21	4	15	201	241
Total Texas	4	0	2	16	22	150	16	38	910	1,114
Louisiana:										
Northern	1	0	1	0	2	5	0	2	50	57
Southern	0	0	0	1	1	8	6	0	40	54
Total Louisiana	1	0	1	1	3	13	6	2	90	111
Arkansas	0	0	0	1	1	2	1	0	50	53
Mississippi	0	0	0	1	1	3	0	0	56	59
Ala., Ga., Florida	0	0	0	2	2	2	0	0	27	29
Montana	0	0	0	1	1	3	0	4	40	47
Wyoming	1	0	1	0	2	16	0	2	18	36
Colorado-Utah	0	0	0	1	1	3	0	1	25	29
New Mexico	0	0	0	1	1	6	0	3	48	57
California	0	0	0	3	3	6	0	8	157	171
Total United States	11	0	4	61	76	371	24	107	2,648	3,150
Total previous week	8	1	0	64	73					

Alabama Gets Two Dry Wildcats

JACKSON.—Alabama drew two more blanks in its wildcat campaign, one in Escambia County and one in Washington County. H. L. Hunt 1 Jones, SW SE SE 3-1n-11e, Escambia County, was dry at 7,450 ft. In Washington County, Humble Oil & Refining Co. B-1 Williams, SW NW 30-6n-4w, was dry at 6,547 ft. Top of the Eutaw was reported at 4,950 ft., and a drill-stem test at 6,295-6,330 ft. recovered only salt water.

ALABAMA WILDCAT COMPLETIONS

Escambia County: Hunt Oil 1 Jones et al, SW SE SE 3-1n-11e, dry, TD 7,450 ft.

Washington County: Humble 1 Williams et al, SW NW 20-6n-4w, dry, TD 6,547 ft., Eutaw 4,950 ft.

KANSAS

Falls City Trend May Reach Into Brown County, Kansas

BROWN County may be given production by Clifton Gall et al 1 Livengood, NE NW SW 2-1s-15e, where porosity and saturation were logged in the Hunton at 2,569-91 ft. This location is about 5 miles southwest of the Falls City pool in Nebraska.

Barton County: Vickers Petroleum Co. 1 Workman, discovery well in the new Workman pool, NE NE NE 33-20s-12w, has been assigned a potential of 221 bbl. from the Arbuckle. The initial rating was 25 bbl. daily.

Cowley County: The Weatherford pool in Cowley County has been given a southeast extension by Davisson-Goodenhauf et al 1 Elder, SW NE 4-32s-3e. The well is making close to 20 bbl. per hour after treatment with 300 gal. acid, producing from the Arbuckle at 3,265-75 ft.

Stafford County: Phillips Petroleum Co. 1 Vivian, NE NE SE 12-23s-12w, 2 miles south of the Richardson pool, may be

(Continued on page 151)

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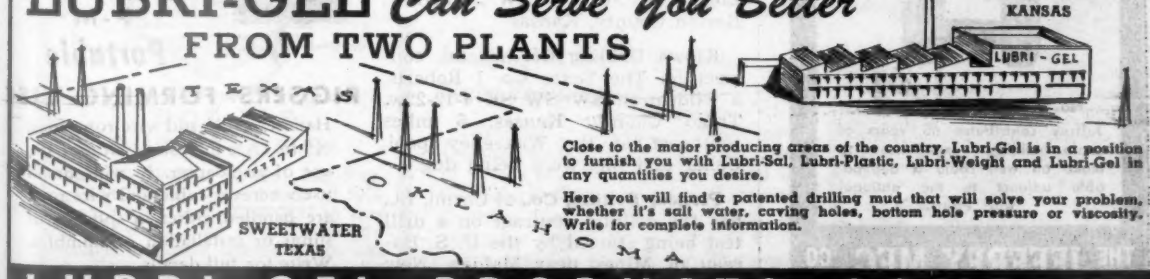

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Here you will find a patented drilling mud that will solve your problem, whether it's salt water, caving holes, bottom hole pressure or viscosity. Write for complete information.

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PROVED
IN PEACE—IN WAR

'BESTOLIFE Lead Seal Joint Compound has been used successfully in the Oil and Refining industries for the past fifteen years. During that time, it has proved itself superior in protecting threads and in providing tight joints which can be broken easily.

Today, 'BESTOLIFE has enlisted in the Navy, Merchant Marine and Defense Plants for the duration, and we are proud of this assignment to help in the Victory effort.

But there are still ample stocks of 'BESTOLIFE available on any priority rating, at supply house field stores in every drilling district in the United States and Canada. USE 'BESTOLIFE Tool Joint Compounds for best results!

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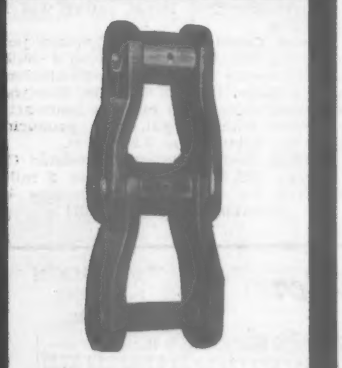
COUNT ON
DEVIL DOG No. 3
for WAR and
for VICTORY



No. 3 Devil Dog A. P. I. 3

Jeffrey contributes 65 years of chain-building experience to make oil well chain a dependable adjunct to the national war effort.

THE JEFFREY MFG. CO.
891-99 N. FOURTH ST., COLUMBUS, O.
Texas Sales Office: 6358 Auden St., Houston

Among the Drilling Contractors

General Petroleums, of Calgary, Alta., has completed drilling of Great Bend-Pacalta 1, LSD 4, 28-52-3w4, in the Marwayne area, northeast of the Vermilion field, and is preparing to test production at 1,924 ft. The same contractors are finishing Great Bend 2 in the Vermilion field.

S.W.S. Drilling Co. of Edmonton, Alta., with J. L. Wilson in charge, has started drilling test for Lloydminster interests 2 miles west of Blackfoot, Alta. Test is in a semi-proven area outlying the Lloydminster field.

S. M. Brooks, Montebello, Calif., drilling contractor, has added a new power rig to his string of one steam rig and two power rigs now in operation.

E. A. Bender, California drilling contractor, has all six of his power rigs in operation in California fields and a full schedule for at least another 6 months, according to Carl Robertson, drilling superintendent.

R. C. Patton Co. has drilling contract on the Model & Roland Co. 1 Gorges, in NW SW NW 8-28-1w, Sedgwick County, Kansas. Location is 1 mile south of the old abandoned Schulte pool.

E. R. Robinson is the drilling contractor on the Rinehart & Pennington 1 McKell, in SW SW NW 36-3n-4e, western Pontotoc County, Oklahoma, 3 miles northeast of the town of Roff.

Don T. Ingling is the contractor on the Maguire Industries, Inc., 1 Logan, in SE NW NW 35-16-14w, Barton County, Kansas.

Kiowa Drilling Co. has the contract on The Texas Co. 1 Roberts, a wildcat in SW SW SE 4-12-22w, Trego County, Kansas, 5 miles southeast of the Wakeeney pool. Cellar and pits were being dug.

Pioneer Drilling Co., of Carmi, Ill., has the drilling contract on a drill test being started by the U. S. Bureau of Mines near Malden, New Madrid County, Missouri. The well is being undertaken for the primary purpose of locating a reserve of magnetite, a magnetic iron ore, and will go to 4,000 or 5,000 ft. and will analyze all formations encountered. The well is located on the Oliver farm in C SW SW 29-22n-11e.

Big Steel Drilling Co. has received contract from Texas Co. to drill approximately 400 holes in an extensive core-drilling campaign in Kansas in which formations will be checked by an electric log of each hole as well as by samples and cores. The contract will keep Big Steel busy for probably a year.

Hinkle Oil Co. is the drilling contractor on the Maguire Industries, Inc., 1 Tretbar, a wildcat 4 miles south of the Zenith pool in SE SW SW 12-25-11w, Stafford County, Kansas.

Herndon Drilling Co., Tulsa, has been awarded contract by Darby & Bothwell, Inc., for the drilling of a wildcat at 1 Freeman, in NE NE NW 29-32-3w, in western Sumner County, Kansas.

W. B. Campbell has the contract for the W. B. Faulkner 1 Hullman, in NE NW NE 11-22-13w, north central Stafford County, within ½ mile of production.

P-M
Portable
RIGGERS' FORMING VISE

Handles cable and wire rope from ⅜" to 1½", inclusive, without the use of an adapter. In widespread use wherever cable and wire rope are handled, either in splicing of slings or installation of thimbles. Write for full details.

PATRICK-McDERMOTT & CO.
415 West Pico, Los Angeles 15, California

CANADIAN FIELDS

Additional Drilling Planned In Steveville-Princess Field

CHATHAM.—In the Steveville-Princess field, east of Calgary, Standard Oil Co. of California 8 Princess, LSD 16, 21-20-3w5, in lime at 3,983 ft. reported initial production of 300 bbl. of 35°-gravity oil, with pressure on tubing 375 lb. and on casing 575 lb. Production is from the Devonian limestone. California Standard and other interests are planning additional drilling.

Athabaska.—In the Athabaska district, northern Alberta, Deca 3 is testing oil sand at 1,748-60 ft. with brown crude of lighter gravity than previously encountered in this field, after getting heavy gas sand at 1,565-75 ft. This is believed the first of four tests to actually get the Grand Rapids sandstone, and Deca 2 and 4 will be deepened to the same horizon.

Vermilion.—Great Bend Oils 2, LSD 2, 29-50-5w4, total depth 1,789 ft., indicates a considerable extension northward of the Vermilion field, with oil standing 750 ft. or more in the hole. Production test is continuing.

South Vermilion.—Vermilion Consolidated 15, LSD 6, 12-49-6w4, a joint deep test by Vermilion Consolidated, Apex and Vermilalta companies 6 miles south of the Vermilion field, has run casing to 4,000 ft. and will deepen to 4,500.

South Turner Valley.—A group of Turner Valley companies, including Imperial Oil, Okalta Oils, Anglo Canadian and Calgary & Edmonton Corp., are considering a Devonian limestone test of South Turner Valley. A previous joint test in the west-central area failed to reach the Devonian on account of faulting but got commercial production in the Madison.

Prince Edward Island.—MacKay Syndicate test, drilling in the bed of Hillsboro Bay, opposite Charlottetown, Prince Edward Island, is coring below 10,350 ft. without a show. This is the first test drilled in the ocean contiguous to Canada.

PENBERTHY

"REFLEX"

WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.

DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

UNIBOLT

THE ONE BOLT COUPLING

NOT BIG BUT STRONG!

Size: 2"; Weight: 12 lbs.; Test Pressure: 6000 lbs; Safety Factor (at 6000 lbs.): 7.3 . . . that's UNIBOLT! (A ring joint flanged union of the same size and test pressure weighs 54 lbs. and has a safety factor of only 6.5.)

THORNHILL-CRAVER COMPANY

HOUSTON

Southwest Texas

(Continued from page 144)

of the field discovered by Henderson Coquat at 3 L. A. Reagan, S. McGloin Survey, Abstract 26, in Live Oak County, and Toro Creek is the name given to the field discovered by Dirks Brothers et al 1-A D. E. Robinson, Jose Maria Uranga grant, in Bee County.

SOUTHWEST TEXAS WILDCAT COMPLETIONS

Brooks County: Sun Oil Co. 6 J. D. Cage, 16 mi. southwest of Falfurrias, Sur. 665, dry at 7,577 ft.

Duval County: Taylor Refining Co. 2-F A. Parr, 6 mi. southwest of San Diego, Sur. 113, dry at 6,040 ft.

Jim Wells County: Rodney Delange and Earl Rowe 1 S. McCarley, 1½ mi. southwest of Sandia, in Bode subd. of Wade Ranch, dry at 4,967 ft.

Refugio County: P. R. Rutherford 1 Smith-Crow, Estevan Lopez 1 League grant, 8 mi. south of Woodsboro, TD 6,505 ft., perforations 24/5,400-04 ft., PT 82.50 bbl. daily ⅛-in. choke, gas-oil ratio 9,268 to 1, TP 1,475 lb., CP 1,590 lb., gravity 24°, no water.

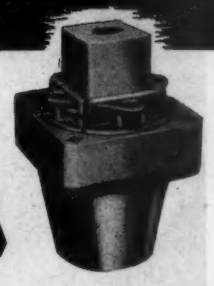
Victoria County: Kingwood Oil Co. 1-A M. F. Bass, Northwest Victoria townsite 4 League grant, TD 4,957 ft., perforations 12/4,887-89 ft., PT estimated 20,000,000 cu. ft. day open, shut-in tubing pressure 2,825 lb., casing pressure 2,975 lb., shut in. No water.

Zapata County: Bridwell Oil Co. 1 Amada C. de Garcia et al, Charco Redondo grant, 19 mi. east of Zapata, dry at 1,490 ft.

Magnolia Posts Price in New West Texas Pool

DALLAS. — Magnolia Petroleum Co. last week posted a gravity scale of prices for crude oil purchased in the Silurio-Devonian pool, Andrews County, Texas, ranging from 93 cents for below 25° gravity to $1.25 per barrel for 40° gravity. The posting is effective September 1 and 100 per cent tank tables apply to strapping.

DRIVING TORQUE CUSHIONED WITH



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Bushing Body is a solid, one piece unit with a corrugated inner core. An oil resistant synthetic rubber cushion absorbs the shock of drilling torque. Bushing is equipped with four slips inside the rubber cushion, faced with liners made of anti-friction material. These liners take all the wear and are reversible for long economical life. Ask the BJ man or see your supplier.

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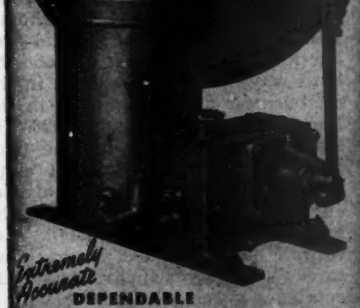
CHEMICAL MEASURING PUMP



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DEPENDABLE

Accuracy of delivery in McCord chemical pumps is the result of a finely engineered design with a minimum number of parts. Dependability is insured because working parts are fully enclosed, protected from dirt and the elements. Specify McCord. For sale by National Supply Co.

Standard of the Oil Fields

McCORD

RADIATOR & MFG. CO., DETROIT, MICH.

PERSONALS

Retention of Texas 'Citizenship' Was Happy Thought

T J. SLAVIK, new general production manager for George W. Strake, independent Gulf Coast operator, has a rich background of operating experience in practically the whole Mid-Continent field. He held a number of responsible assignments for a period of 18 years with the Tulsa division of the Gulf Oil Corp. Operations for which he was responsible while with Gulf ranged from drilling and production supervisory work in various fields, to assistant in the executive department on special problems.

Slavik, an engineer, attended the universities of Texas and Oklahoma. His present position of general production manager was earned the hard way, because he started in the oil business as a roughneck in the Pierce Junction field, in 1926. He was district engineer for the Gulf at Tonkawa in 1928, district engineer at Burbank, and chief district engineer at Hobbs, N. M., during the extensive drilling campaign. According to his friends, he has that rare personality which successfully combines a sense of humor with a driving force to get jobs done efficiently.

Slavik was born in Hallettsville, Tex., in 1903. He says that during his long sojourn in the Mid-Continent area, he conscientiously kept his Texas "citizenship" papers in effect, and that his recent resignation from Gulf and subsequent removal to Texas was simply a homecoming to him.

James C. Scully, regional fuel-rationing officer of the Office of Price Administration in Seattle, has been appointed chief of the fuel-rationing branch in the national office in Washington.

Edward C. Borrego, who has been with the Petroleum Section, A.F.Hq. in Italy, now has the rank of major. Before joining the Army he was in charge of drilling for the Creole Petroleum Corp. in eastern Venezuela.

John H. Jennings has recently resigned his position with the Ohio Oil Co. in Bakersfield, Calif., to open consulting engineering offices in the Philtower Building, Tulsa. Jennings was employed in the Rocky Mountain area with Mountain Fuel Supply Co. before going to California with the Ohio company. Previous to this time he was associated with the Sunray Oil Corp. in Tulsa.

Ted R. Lindsay is district manager and **A. W. Rea** is drilling superintendent at the Mount Vernon, Ill., district office opened recently by Exploration Drilling Co., Tulsa.

Dr. Byron B. Boatright, consulting oil and gas engineer of Houston, was appointed technical consultant to the state-wide committee of oil men opposing Senate ratification of the Anglo-American agreement.

Edward W. Lloyd, who has been discharged from the Navy after 2 years' service, has formed a partnership with **Robert E. Paradise,** who has been with Richfield Oil Corp. since 1937, and will deal with oil litigation, leases, and similar matters.

Dr. E. F. Davis, vice president of Shell Oil Co., Inc., recently entertained a group of southern California operators and executives in honor of **G. Legh-Jones** who is making an inspection trip of California operations. Legh-Jones, who formerly headed Shell's California operations, now makes his home in London.

Campbell M. Hunter, O.B.E. of London, who has been engaged in war work in England, is revisiting Alberta, Canada, to inspect recent oil developments there. As a petroleum geologist, Hunter did considerable work some years ago in the Alberta fields.

R. Lane Grigsby, formerly of Shreveport, has been named general manager of a newly formed oil corporation, the Luboil Corp., of Evansville, Ind.

Eugene Holman, president, Standard Oil Co. (New Jersey), **W. S. S. Rodgers,** chairman, The Texas Co., and **Earle W. Webb,** president, Ethyl Corp., all of New York, have been selected members of the American delegation to participate in the International Business Conference at Rye, N. Y., November 10-18. The American group, consisting of more than 40 industrial leaders, will confer with representatives of organized business from allied and friendly nations to discuss the conditions under which international trade may be resumed.

Dean Tannehill, J. E. O'Riordan and **Emmett Wilson** have resigned positions with Pan American Pipe Line Co. to open an office as consulting engineers in Houston. Tannehill was general superintendent of the pipe-line company, having been promoted to that post from the division superintendency of the southern division.

T. M. Chubb has been appointed chief gas engineer and assistant secretary of Pacific Lighting Corp., with headquarters in Los Angeles, according to an announcement by **LeRoy M. Edwards,** vice president and general manager of the company. Chubb had been associated with the Office of War Utilities, Natural Gas Division, in Washington, D. C., as western area chief for almost 2 years. For 6 years prior to that time, he was senior engineer of the California Railroad Commission, Gas and Electric Division. Previously, he had been in the natural gas utility business in California.

Dr. Sidon Harris, former division seismograph supervisor for Stanolind Oil & Gas Co. in the Fort Worth division, has resigned to open an office in Fort Worth for Southern Exploration Service. Dr. Harris was associated with Stanolind for 10 years.

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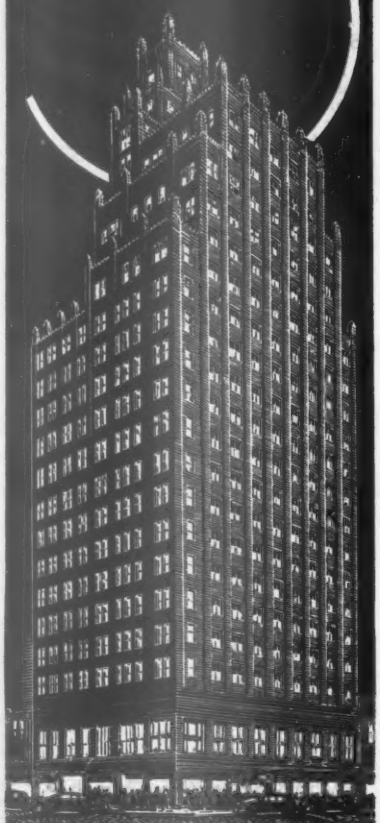

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The BLACKSTONE
FORT WORTH'S HOTEL OF DISTINCTION
JOE T. O'KEEFE, President
E. B. HANNA, Manager

Kansas Fields

(Continued from page 147)

giving Stafford County a new pool. On a swabbing test made from the Arbuckle at 3,679-84 ft., the well made 12 bbl. oil for 4 hours.

Wellington County: The Texas Co. 1 Cramer, SE SE SE 3-32s-2w, 5 miles west of the Wellington pool in Sumner County, may make an oil well. Oil was logged in the Mississippi at 3,587 ft., and the operator is now testing. The present total depth is 4,464 ft. in the Arbuckle.

Kansas operations are on the uptrend again, with 54 new starts, including 14 wildcat locations. New wildcats are fairly well scattered with two each for Barton and Ellis counties, and one apiece in Butler, Graham, Greenwood, Lane, Pratt, Rooks, Stafford, and Trego counties. This compares with 43 completions this week, of which 12 were wildcats.

KANSAS WILDCAT COMPLETIONS

Barber County: Texas 1 Groendycke, SW SW SE 27-33s-12w, dry, TD 5,352 ft., Arbuckle 5,318 ft.

Cowley County: Texas 1 Wahlenmaier, NW NE NW 13-34s-4e, dry, TD 3,836 ft., Arbuckle 3,721 ft.

Jefferson County: Dan McLaughlin 1 Bank of McLouth, NE SE NE 17-10s-20e, dry, TD 1,724 ft., Mississippi lime 1,580 ft.

Marion County: Texas 1 Weinbruner, SW NW NW 36-19s-1e, dry, TD 3,350 ft., Arbuckle 3,290 ft.

McPherson County: Bay Petroleum 1 Decker, SE SE SE 11-20s-3w, dry, TD 3,596 ft., Simpson 3,549 ft.

Pratt County: Superior 1 Patterson, SE SE SW 16-28s-13w, dry, TD 4,654 ft., Arbuckle 4,584 ft.

Skelly 1 Shriver, NE NE NE 33-29s-14w, flowed 344 bbl. oil, 125,000 cu. ft. gas, and no water from pay zone 4,557-4,564 ft., TD 4,679 ft., Simpson 4,555 ft., Simpson sand 4,557 ft., Arbuckle 4,654 ft.

Reno County: Continental et al 1 Hodge, NE NE SW 15-22s-8w, dry, TD 3,808 ft., Arbuckle 3,756 ft.

Rice County: Ben Hyde 1 Hammel, CSL NE NE 16-19s-10w, dry, TD 3,161 ft., base Kansas City 2,965 ft.

Lauck & Moncrief 1 Sieverburg, NW SW SE 17-19s-10w, dry, TD 3,362 ft., Arbuckle 3,332 ft.

Rush County: Coralena 1 Brack, CSL SW SE 10-17s-16w, dry, TD 3,363 ft., Kansas City 3,267 ft.

Saline County: Phillips 1 Ryan, NE NE SE 17-14s-1w, dry, TD 3,568 ft., Arbuckle 3,412 ft.

Stafford County: Stanolind 1 Voight, CSL NE SE 11-22s-12w, pumped 45 bbl. from the Arbuckle, TD 3,632 ft., Simpson —1,719 ft., Arbuckle —1,783 ft.

Sumner County: Bay Petroleum et al 1 Dennett, NE NE SW 23-33s-3w, dry, TD 4,565 ft., Simpson 4,510 ft.

NEBRASKA WILDCAT COMPLETIONS

Hitchcock County: Texas 1 Taunton, SE NW NW 22-2n-35w, dry, TD 4,664 ft., Reagan 4,645 ft., granite 4,662 ft.

CALENDAR

November

A.P.I., annual directors meeting, Statler Hotel, Washington, D. C., November 7.

S.A.E., national fuels and lubricants conference, Mayo Hotel, Tulsa, November 9-10.

A.C.S., third national chemical exposition, Coliseum, Chicago, November 15 to 19.

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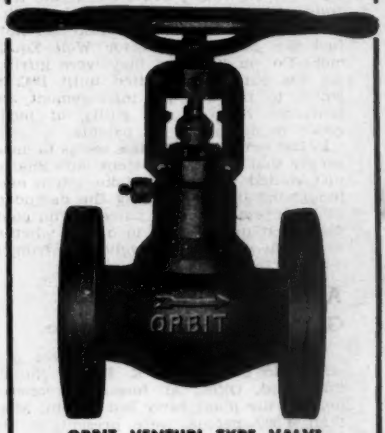
VS
WING VALVES

The ORBIT VENTURI TYPE VALVE is manufactured with Stellite "J" Metal Seats which will not only withstand the abrasion of sand but is also corrosion resistant to all type of crude oil.



ORBIT VENTURI TYPE VALVE

This valve can be furnished thru all fabricators of Xmas Trees or thru any of your local supply stores at a price comparable to that of leading plug valves YET this valve requires no lubrication to effect a seal.

See 1944 Composite Catalog

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Industrial Items

Decision Rendered in Shaffer-Rector Suit

A decision in a patent infringement suit has been recently made by Judge James C. Wilson of the U.S. District Court of Fort Worth, which should be of general interest to the oil industry. The decision is based on the law of laches or delay in bringing suit.

(William D. Shaffer of the Shaffer Tool Works of Brea, Calif., brought suit against Rector Well Equipment Co., Inc., of Fort Worth on four patents relating to casing heads.) Although the validity of these patents and their noninfringement by Rector were vigorously contested at the trial, Judge Wilson in his opinion, held that owing to the fact that Shaffer had notified the defendant, Rector Well Equipment Co., in 1934 that they were infringing his patent, he waited until 1943 in which to file suit for infringement and therefore Shaffer was guilty of negligence in defending his patents.

In layman's language this seems to mean simply that under the patent laws Shaffer just waited too long to take action even though he began notifying the defendant of infringement of his patents. The court deemed it unnecessary to decide whether or not the patents were valid or infringed.

Army-Navy Award to George E. Failing Supply Co.

The Army-Navy "E" award was presented to the George E. Failing Supply Co., Enid, Okla., at formal ceremonies held at the plant early last month. More than 1,000 people were present at the ceremonies, including high officials of the Army and Navy and representatives of major oil companies. George E. Failing, president of the company, accepted the award. The Failing company manufactures portable oil-field and mining-drilling equipment in peacetime, and is a wartime manufacturer of water-well drilling units for the armed forces.

Ladish Opens Houston Office

Ladish Drop Forge Co., fittings division, announces the opening of its Houston office, serving the southwestern territory. The offices, under the direction of W. O. Kupper, are located in the Sterling Building.

Gas-Fueled Engine Supplies Power for Office Building

An example of how office buildings, industrial plants or other commercial institutions can obtain all their electric power requirements at low cost and with a minimum of maintenance is typified by the power generating installation at Lone Star Gas Co., Dallas. The equipment consists of a 7-year-old Type GNG gas-fueled engine supplied by the Cooper-Bessemer Corp., Mount Vernon, Ohio, and Grove City, Pa. It is of the eight-cylinder size developing 400 hp., and furnishes all power requirements for Lone Star's 13-story Wood Street Building, including lighting and power for the electrically operated elevators.

According to the tabulated yearly record of the engine's performance during 1943, the unit's lubricating oil consumption averaged 4,075 rated horsepower hours per gallon for 1943.

The engine is cooled by means of an enclosed system operating through a Carrier evaporative condenser on the roof of a court on the building's second floor. The exhaust pipe is carried up an outside corner of the building to the roof, 11 stories.

The ignition cables are carried in 1¼-in. tubing mounted on the heads directly above the starting air header. The rocker arms of the engine are lubricated from the regular force-feed system of the engine. In order to control the amount of oil going to the rocker arms, through the small header serving them, a needle valve was installed in this small header enabling complete control of the amount of oil going to the rocker arms.

Engines such as described in this article are convertible from gas to diesel operation or vice versa, depending upon the availability of fuel at the point of installation.

Columbia Office Closed

Consolidation of the Columbia, S. C., and Atlanta, Ga., offices of Pittsburgh Equitable Meter Co.-Merco Nordstrom Valve Co. has been announced coincident to the retirement of F. G. Swaffield, district manager of the firm's Columbia office. Announcement of the change was made by A. J. Kerr, general sales manager. C. C. Moore, manager of the Atlanta district office, now directs field sales in the entire southeast section of the United States.

Wiewel Named National Tube Co. Executive

C. R. Cox, president of National Tube Co., has announced the appointment of Walter H. Wiewel as assistant to the president. He will engage in the planning and development of future markets and facilities for the production of tubular products.

Since 1942, Wiewel has served as chief of the tubing branch, steel division of the War Production Board, and also as vice chairman of WPB's production directive committee.

Joins Sunshine Iron Works

M. L. "Jack" Cunningham, formerly drilling engineer for Gulf Oil Corp. in the Permian basin area of West Texas, is now with Sunshine Iron Works, Odessa, Tex. Cunningham is engaged in development of the SIW mud screen and its distribution.

Firm Changes Name

McCord Corp. is the new name of the former McCord Radiator & Manufacturing Co., of Detroit, according to a recent announcement of the company.

Griffith Rejoins Petroleum Machinery Corp.

L. F. Griffith, formerly deputy chief, Materials Distribution Section, Power Division, Office of War Utilities, will rejoin the staff of Petroleum Machinery Corp., New York, November 15, as power engineer in connection with the supply of equipment for power projects in the petroleum industry and other power developments in the foreign field.

Patterson-Kelley Appoints Mid-Coast Sales Co.

Patterson-Kelley Co., Inc., East Stroudsburg, Pa., announces the appointment of Mid-Coast Sales Co., Esperson Building, Houston, to handle in Texas, Louisiana and Oklahoma the sales of its heat exchangers and special equipment for Petro-Chemical Industries. Mid-Coast Sales Co. was reeently organized by Bernard F. Fallon.

Meyer Heads Association

Walter A. Meyer, Allis-Chalmers manager of dealer sales, was elected president of the Multiple V-Belt Drive Association at its meeting in Cleveland.

Meyer was vice president and chairman of the executive committee before his election as president. Other officers of the association are William D. Hamerstadt, Indianapolis, Ind., vice president, and A. B. Anderson, Chicago, Ill., secretary-treasurer.

Walter Geist, Allis-Chalmers president, was the first head of the association when it was formed 10 years ago.

Sales Organization Formed

Industrial Power Units, Inc., 133 North Center Street, Casper, Wyo., has been organized to promote the sale and service of Le Roi gas engines, Tulsa truck winches and Allis-Chalmers Texdrive and industrial motors in the Rocky Mountain area. The company is headed by Frank E. Gehring as president.

Powers Joins Texas Iron Works

W. W. "Red" Powers has joined Texas Iron Works Co. and will be the company's representative in Louisiana with headquarters in Houma. Powers has been connected with the oil industry for many years, having worked for The Texas Co. and Mid-Continent Supply Co.

Sprankle Joins Timken Steel & Tube Division

A. F. Sprankle has been appointed metallurgical engineer in Timken Steel and Tube Division, according to a recent announcement by Timken Roller Bearing Co., Canton, Ohio. He was formerly manager of the alloy bureau of Carnegie-Illinois Steel Corp. in the Pittsburgh district

Trade Literature

Marlow Pumps, Ridgewood, N. J.—An 80-page catalog on the company's line of pumps. The catalog conforms with a perpetual decimal reference system.

South Bend Lathe Works, South Bend, Ind.—Catalog No. 100-D, featuring 21 full-color illustrations, describing all the company's engine, toolroom, and precision turret lathes. Complete specifications are listed opposite each lathe illustration.

Niagara Blower Co., 6 East Forty-fifth Street, New York.—Bulletin 98, which includes a colored operating drawing of the Niagara aero feed cooler.

Weatherford Spring Co., Weatherford, Tex.—Catalog on the company's line of spiral casing centralizers, straight casing centralizers, wall-cleaning scratchers, cement-retaining baskets and industrial springs.

Graver Tank & Manufacturing Co., Inc., East Chicago, Ind.—A 24-page bulletin covering the company's line of tanks and pressure vessels.